DANA SPICER®
Off-Highway Products

Service Manual

Powershift Transmission
T16000

TSM-0030
November 1996

TOWING OR PUSHING

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

Note: If the transmission has 4 wheel drive, disconnect both front and rear drivelines. Because of the design of the hydraulic system, the engine cannot be started by pushing or towing.

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FOREWORD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the **CLARK-HURTH COMPONENTS** product.

Extreme care has been exercised in the design, selection of materials, and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, its principle of operation, troubleshooting, and adjustments, it is urged that the mechanic study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only **Clark-Hurth Components**-approved parts as listed in the applicable parts manual should be used. Use of “will-fit” or non-approved parts may endanger proper operation and performance of the equipment. **Clark-Hurth Components** does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by **Clark-Hurth Components.**

Important: Always furnish the Distributor with the serial and model number when ordering parts.

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SAFETY PRECAUTIONS

To reduce the chance of personal injury and/or property damage, the following instruction must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the machine. If replacement parts are required the part must be replaced with one of the same part number or with a equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended in this manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure or tool, which is not recommended by Clark-Hurth, must first determine that neither his safety nor the safe operation of the machine will be jeopardized by the replacement part, service procedure or tool selected.

It is important to note that this manual contains various 'Cautions' and 'Notices' that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the unit or render it unsafe. It is also important to understand that these 'Cautions' and 'Notices' are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

CLEANING AND INSPECTION

CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

CAUTION: Care should be exercised to avoid skin rashes, fire hazards, and inhalation of vapours when using solvent type cleaners.

BEARINGS

Remove bearings from cleaning fluid and strike flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

HOUSINGS

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

CAUTION: Care should be exercised to avoid inhalation of vapours and skin rashes when using alkali cleaners**.**

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal fillings, contaminated oil, or lapping compound.

INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

BEARINGS

Carefully inspect all rollers: cages and cups for wear, chipping, or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

OIL SEALS, GASKETS, ETC.

Replacement of spring load oil seals, O-rings, metal sealing rings, gaskets, and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all O-rings and seals with recommended type Automatic Transmission Fluid before assembly.

GEARS AND SHAFTS

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

HOUSING, COVERS, ETC.

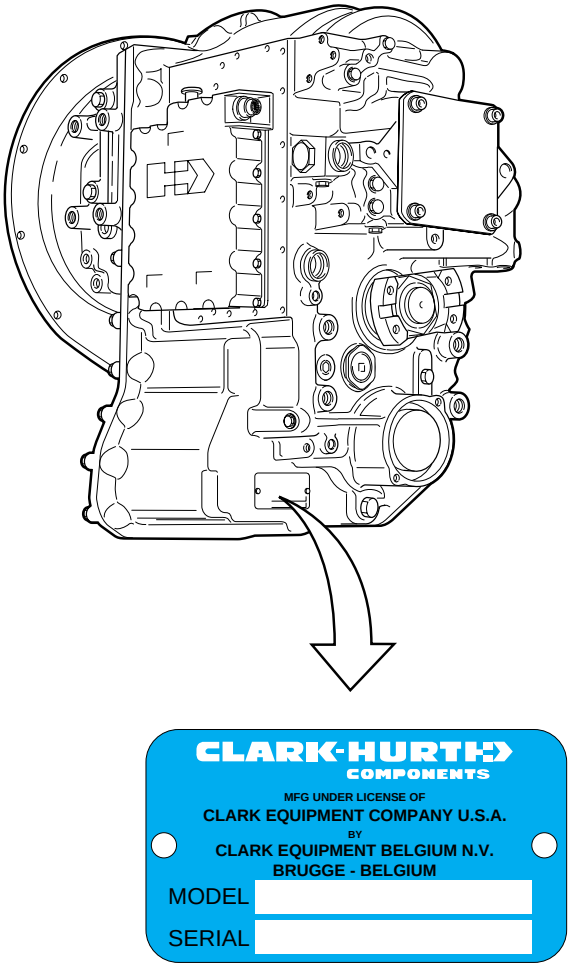
Inspect housings, covers and bearing caps to be certain they are thoroughly clean and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

Legend symbols

	Smontaggio di sottogruppi Disassembly of assembly groups
	Montaggio di sottogruppi Reassemble to from assembly group
	Smontaggio di particollari ingombranti Remove obstruction parts
	Montaggio di particollari ingombranti Reinstall - remount parts which had obstructed disassembly
	Attenzione, indicazione importante Attention! important notice
	Controllare regolare p.e. coppie, misure, pressione etc. Check - adjust e.g. torque, dimensions, pressures etc.
	T = Attrezzature speciali P = Pagina T = Special tool P = Page
	Rispettare direzione di montaggio Note direction of installation
	Controllare esaminare controllo visuale Visual inspection
	Eventualimente riutilizzable (sostituire se necessario) Possibly still serviceable, renew if necessary

	Sostituire con ogni montaggio Renew at each reassembly
	Togliere - mettere la sicura Unlock - lock e.g. split pin, locking plate, etc.
	Mettere la sicura, incollare (mastice liquido) Lock - adhere (liquid sealant)
	Evitare danni ai materiali, danni ai pezzi Guard against material damage, damage to parts
	Marchiari prima dello smontaggio (per il montaggio) Mark before disassembly, observe marks when reasembl.
	Carricare riempire (olio - lubrificante) Filling - topping up - refilling e.g. oil, cooling water, etc.
	Scarricare olio, lubrificante Drain off oil, lubricant
	Tendere Tighten - clamp ; tightening a clamping device
	Insere pressione nel circuito idraulico Apply pressure into hydraulic circuit
	Pulire To clean

TECHNICAL SPECIFICATIONS



A. IDENTIFICATION OF THE UNIT

1. Model and type of the unit
2. Serial number

B. WEIGHT, DIMENSIONS, OIL CAPACITY

Weight (dry)	290 kg	(639 lb)
Maximum length	705,3 mm	(27,8”)
Maximum width	465 mm	(18,3”)
Maximum height	648 mm	(25,35”)

Oil capacity:

14 l (3,7 US Gallon) without cooler and hydraulic lines.
Consult operator’s manual on applicable machine for system capacity

C. TIGHTENING TORQUE'S

Torque table for bolts.

(Based in VDI 2230, μ = 0,14 and CCI standard)
All threads must be lubricated before assembly.

Metric			**Inch**		
Class 8,8	Torque		Grade 5	Torque	
	Nm	lbft		Nm	lbft
M5 x 0,8	5 - 6	3,7 - 4,4	0,5000	87-95	64,1 - 70,0
M8 x 1,25	20 - 25	14,7 - 18,4			
M10 x 1,5	40 - 50	29,5 - 36,8			

Torque tables for plugs (o-ring ports)

Metric			**Inch**		
Size	Torque		Size	Torque	
	Nm	lbft		Nm	lbft
M10 x 1	8 - 10	5,9 - 7,4	1,3125 - UN	112 - 140	82,5 - 103,2
M22 x 1,5	48 - 60	35,4 - 44,2			
M33 x 2	112 - 140	82,5 - 103,2			

Torque tables for pipe plugs

Metric			**Inch**		
Size	Torque		Size	Torque	
	Nm	lbft		Nm	lbft
M22 x 1,5 UNI 7707	48 - 60	35,4 - 44,2	0,1250 - 27 NPTF	9 - 13	6,6 - 9,6

Output flanges

339 - 407 Nm (250 - 300 lbft).

Filter torque

30-38 Nm (22,1-28 lbft).

Control valve

Connector nut to cover: 6 - 8 Nm (4,4 - 5,9 lbft).

D. PRESSURE AND TEMPERATURE SPECIFICATIONS

- Normal operating temperature 70 - 120°C (158 - 248F) measured at temperature check port to cooler (port 71 - **).
- Maximum allowed transmission temperature 120°C (248 F).
- Transmission regulator pressure (*) - (neutral 2nd speed) - port 31 (**).

  - at 600 RPM min. 16,5 bar (239 PSI).

  - at 2200 RPM : 19,6 - 23,1 bar (284 - 335 PSI).

- Pump flow (*)

  - at 2200 RPM in neutral 2nd speed : 64,9 l/min. minimum (17,1 GPM).

  - at 2200 RPM in reverse 1st, 2 nd, forward 1st, 2nd maximum 3 l/min. (0,8 GPM) less than in neutral 2nd.

  - at 2200RPM in forward 3rd and 4th : maximum 5l/min. (1,3 GPM) less than in neutral 2nd.

- Clutch pressures (*)

  - 1st clutch : port 41 (**).

  - 2nd clutch : port 42 (**).

  - forward high clutch : port 44 (**).

  - forward low clutch : port 45 (**).

  - reverse clutch : port 46 (**).

  - disconnect clutch : port 47 (**).

  at 2200 RPM :

  - 18,1 - 21,5 bar (263 - 312 PSI) clutch activated.

  - 0 - 0,2 bar (0 - 3 PSI) clutch released.

- Filter bypass valve set at 4,1 - 5 bar(*) (59 - 73 PSI), measured between port 31 and 35.

- Lube pressure (*) (port 33) - 0,3 - 0,5 bar (4,3 - 7,3 PSI) at 47 l/min. (12,4 GPM) pump flow (±1800 RPM).

- Internal leakage (*) 1,5 - 3,0 l/min. (0,4 - 0,8 GPM) for each clutch.

  Max. total leakage 6,8 l/min (1,8 GPM) (clutch leakage dir. + range + converter leak + valve leak) without disconnect clutch.
- Safety valve : cracking pressure (*) 9,5 - 10,5 bar (138 - 152 PSI), measured at port 34.
- To cooler (converter out) pressure (*) (port 32) 2 bar min. (29 PSI) at 2000 RPM and max. 5 bar (73 PSI) at no load governed speed).
- Converter by pass valve set at 5 - 7 bar (*) (73 - 102 PSI), measured between port 33 and 34.

(*) All pressures and flows to be measured with oil temperature of 82 - 93° C (180 - 200F).
(**) Refer to section troubleshooting for check port identification.

E. ELECTRICAL SPECIFICATIONS

- Solenoid (forward reverse, high/low, 2nd/1st, modulation, disconnect)
  coil resistance : 28 Ω ± 2 Ω (20°C).

- Electronic controlled modulation valve :
  coil resistance : 3,55 Ohm (± 0,25 Ohm) at 20°C (68F).

- Speed sensor :
  - type: magneto resistive sensor with 7/14 mA current loop.
  - frequency: 0 - 25000 Hz.
  - sensing distance: 0 - 2,5 mm.

- Temperature sensor (in speed sensor) resistance versus temp: see table.

T_{amb} °C	Resistance Ω
-55	980
-50	1030
-40	1135
-30	1247
-20	1367
-10	1496
0	1630
10	1772
20	1922
25	2000
30	2080
40	2245

T_{amb} °C	Resistance Ω
50	2417
60	2597
70	2785
80	2980
90	3182
100	3392
110	3607
120	3817
125	3915
130	4008
140	4166
150	4280

F. HYDRAULIC COOLER LINES SPECIFICATIONS

- Minimum 19 mm internal diameter for lines and fittings.

- Suitable for operation from ambient to 120° C continuous operating temperature.

- Must withstand 20 bar continuous pressure and with 40 bar intermittent surges.

- Conform SAE J1019 and SAE J517,100RI.

MAINTENANCE

A. OIL SPECIFICATION

ATF oil only which meets following specifications:

- ATF Elfmatic G3.

A. MAINTENANCE INTERVALS

- **Daily:**

  Check oil level daily with engine running at idle (600 RPM) and oil at 82 - 93°C (180 - 200 F).

  Maintain oil level at full mark.

- **Normal drain period:**

  Normal drain period and oil filter change are for average environment and duty cycle condition.

  Severe or sustained high operating temperature or very dusty atmospheric conditions will cause accelerated deterioration and contamination.

  For extreme conditions judgement must be used to determine the required change intervals.

  - Every 1000 hours change oil filter.
  - Every 1000 hours drain and refill system as follows:

    Drain with oil at 65 - 93°C (150 - 200 F).

    1. Drain transmission.
    2. Oil filter, remove and discard, install new filter.
    3. Refill transmission (14 litres) (3,7 G).
    4. Run engine at idle (600 RPM) to prime converter and lines.
    5. When oil temperature is at 82 - 93°C (180 - 200 F) adjust oil level to full mark.

Note: It is recommended that oil filter be changed after 100 hours of operation on new, rebuilt or repaired unit.

C. SERVICING MACHINE AFTER COMPONENTS OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the driveline between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other; therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered complete.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgement must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter elements cleaning out filter cases thoroughly.
4. The oil cooler must be thoroughly cleaned. The cooler should be “back flushed” with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air, and steam cleaner for that purpose. **DO NOT** use flushing compounds for cleaning purposes.
5. Reassemble all components and use only type oil recommended for lubrication section. Fill transmission through filler opening until fluid comes up to the oil level check port.

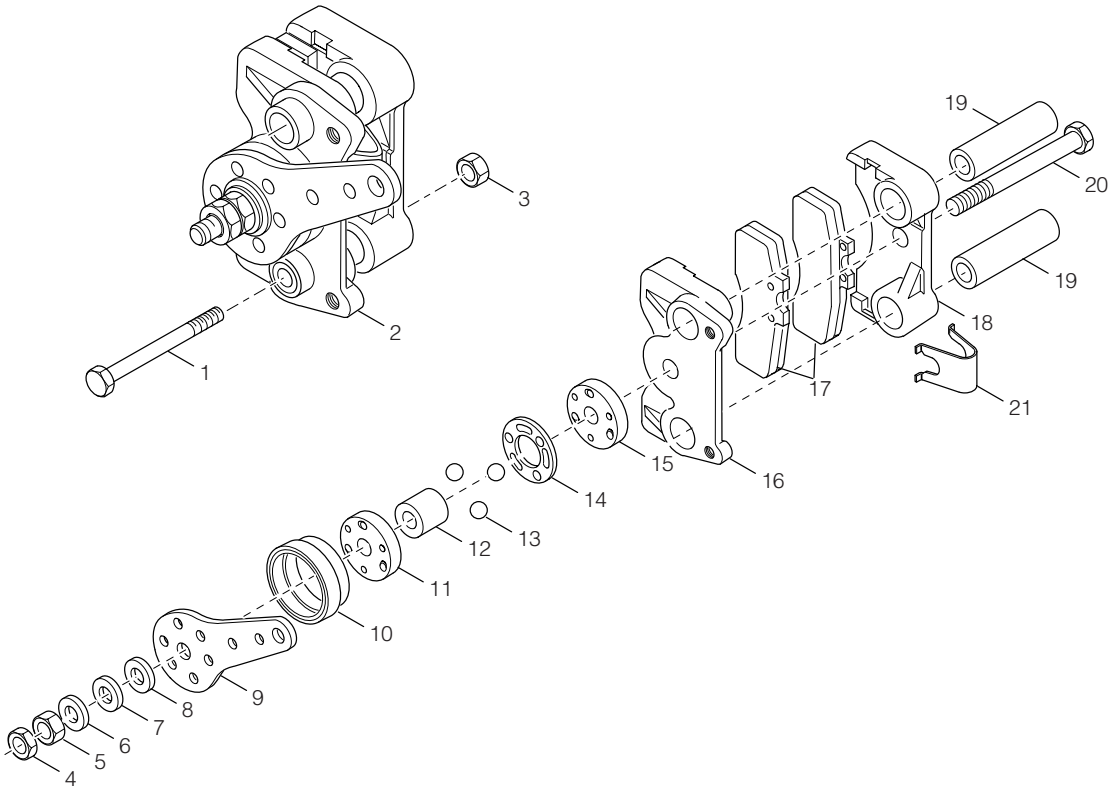
   Run engine 2 minutes at 500+600 R.P.M. to prime torque converter and hydraulic lines. Recheck level of fluid in transmission with engine running at idle (500-600 R.P.M.).

   Add quantity necessary to bring fluid level to oil level check port.

   Recheck with hot oil (180-200 F) 82-93° C.
6. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

D. INSTRUCTIONS FOR LINING REPLACEMENT AND ADJUSTMENT OF PARKING BRAKE ASSEMBLY

1. Loosen two adjustment locking nuts (4 & 5) enough to slide each torque plate (16 & 18) away from disc far enough to provide clearance to remove old carrier and lining assemblies and install new ones. (It may be necessary to remove one or both nuts).
2. Collapse lining retraction spring (21) and remove from brake head assembly.
3. Slide torque plates (16 & 18) away from disc, move carrier and lining assemblies (17) out of pockets, and remove from the brake head assembly from the side.
4. Install new carrier and lining assemblies (17) in each torque plate (16 & 18).
5. Install lining retention spring (21) into brake head assembly. Be sure spring's "feet" are positioned properly in holes in both lining carrier assemblies (17).
6. Tighten inner adjusting nut (5) until firm contact is made with the disc by the linings. Torque to (100 lbs-in) 11 Nm make certain lever is in proper operating position for application.
7. Back off inner adjusting nut 4 (5) to 5 flats and check that disc is free to move (total clearance 0,8 - 1,1 mm (0.031 - 0.043)).
8. Tighten outer locking nut (4) against inner adjusting nut to lock adjustment bolt in place. Torque to (45 to 55 lb-ft.) 61 - 75 Nm.

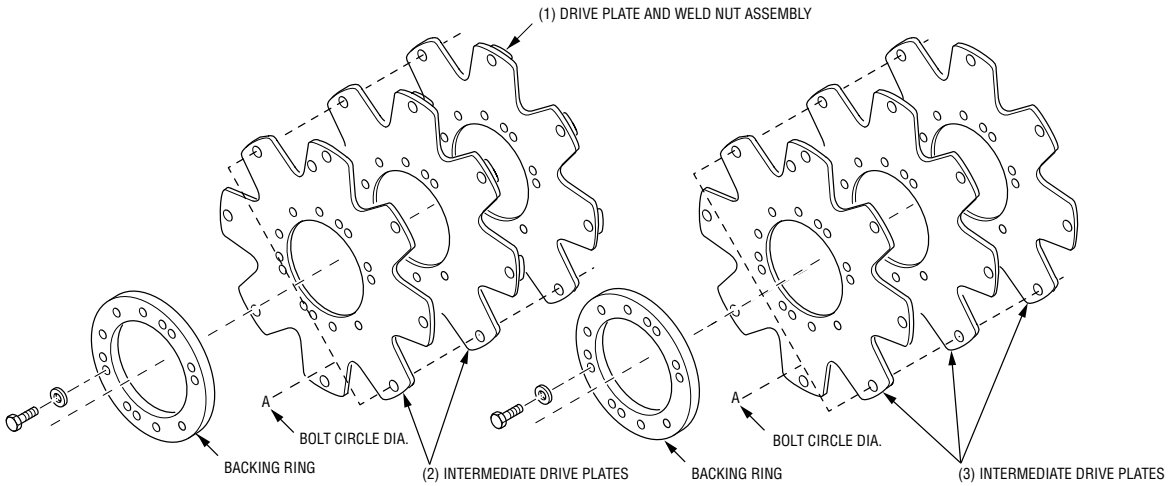


INSTALLATION DETAILS

A. CONVERTER DRIVE COUPLING

Measure the “A” dimension (bolt circle diameter) and order drive plate kit listed below.

Note two (2) kits have (2) intermediate drive plates and one (1) drive plate and weld nut assembly. Two (2) kits with three intermediate drive plates.



“A” Dimension (Bolt circle diameter)

- 13.125” (333,38 mm) diameter
  Kit No. 802424
- 13.500” (342,90 mm) diameter
  Kit No. 802425

Each kit will include the following parts:

- 2 Intermediate drive plates
- 1 Drive plate and weld nut assembly
- 1 Backing ring
- 6 Mounting screws
- 6 Lock washers
- 1 Instruction sheet

“A” Dimension (Bolt circle diameter)

- 13.125” (333,38 mm) diameter
  Kit No. 802426
- 13.500” (342,90 mm) diameter
  Kit No. 802427

Kit will include the following parts:

- 3 Intermediate drive plates
- 1 Backing ring
- 6 Mounting screws
- 6 Lock washers
- 1 Instruction sheet

Position drive plate and weld nut assembly on torque converter assembly with weld nuts toward converter. Align intermediate drive plates and backing ring with holes in torque converter assembly.

Note: Two dimples 180° apart in backing ring must be out (Toward the engine flywheel).

Install cap screws and washers. Tighten (26 to 29 lbft) torque 35 - 39 Nm.

B. TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.
2. Check engine flywheel & housing for conformance to standard SAE No. 3 per SAE J927 and J1033 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play.
3. Install two (2.50) 63,500 mm long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.

*4. Install a (4.00) 101,60 mm long drive plate locating stud .3750 - 24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No. 3.

5. Rotate the transmission torque converter to align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No. 3. Locate transmission on flywheel housing.

   Aligning drive plate to flywheel and transmission to flywheel housing guide studs, install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.

*6. Remove drive plate locating stud.

7. Install drive plate attaching screw and washer. Snug screw but **do not tighten**. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed torque one (26 to 29) lbft torque 35 - 39 Nm. This will require tightening each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened to specified torque.
8. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within (.001) 0,025 mm of the end play recorded in step No. 2.

* Does not apply to units having 3 intermediate drive plates. (See fig. 4)

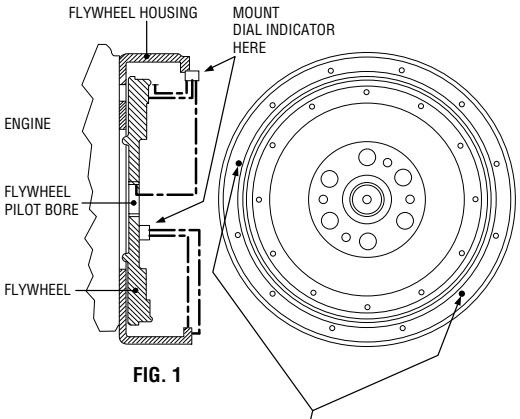


FIG. 1

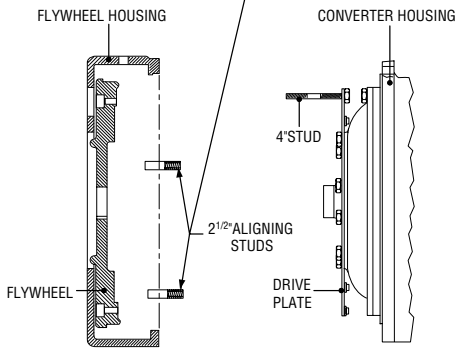


FIG. 2

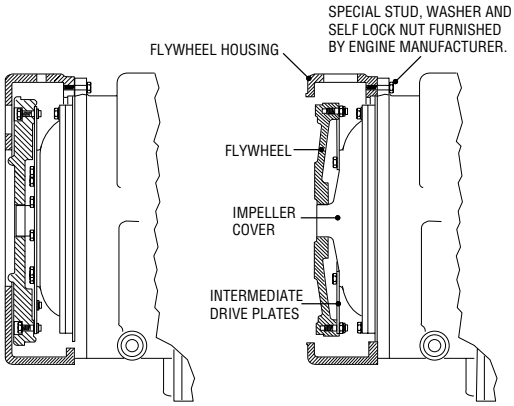
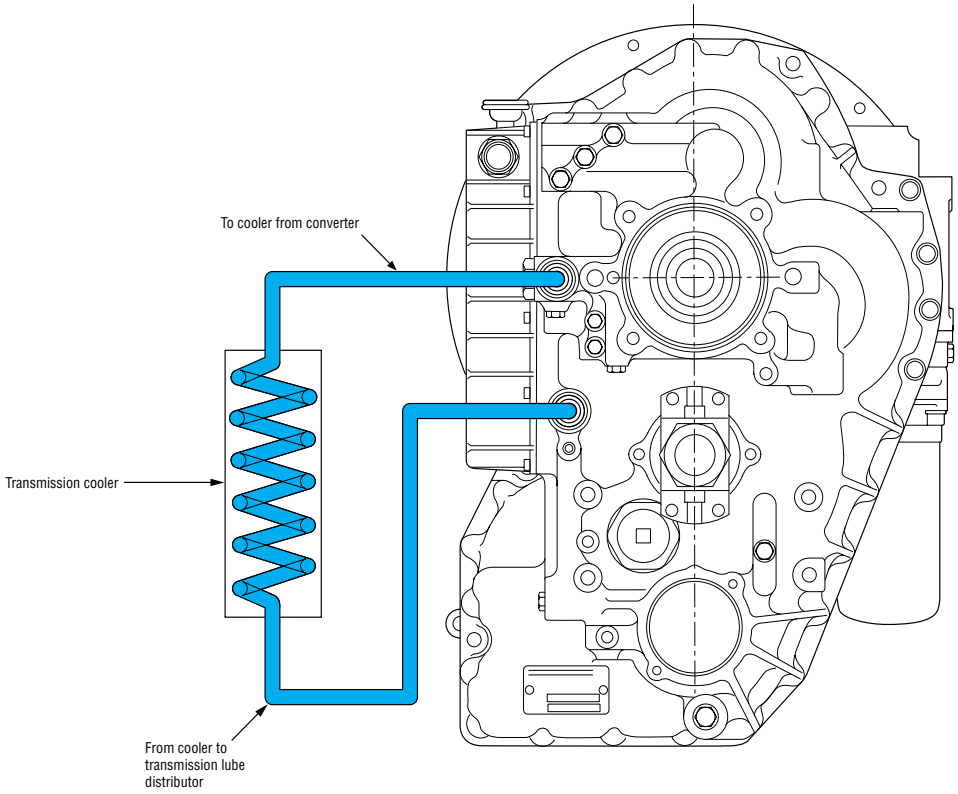


FIG. 3 FIG.4

C. EXTERNAL PLUMBING



Cooler lines specifications

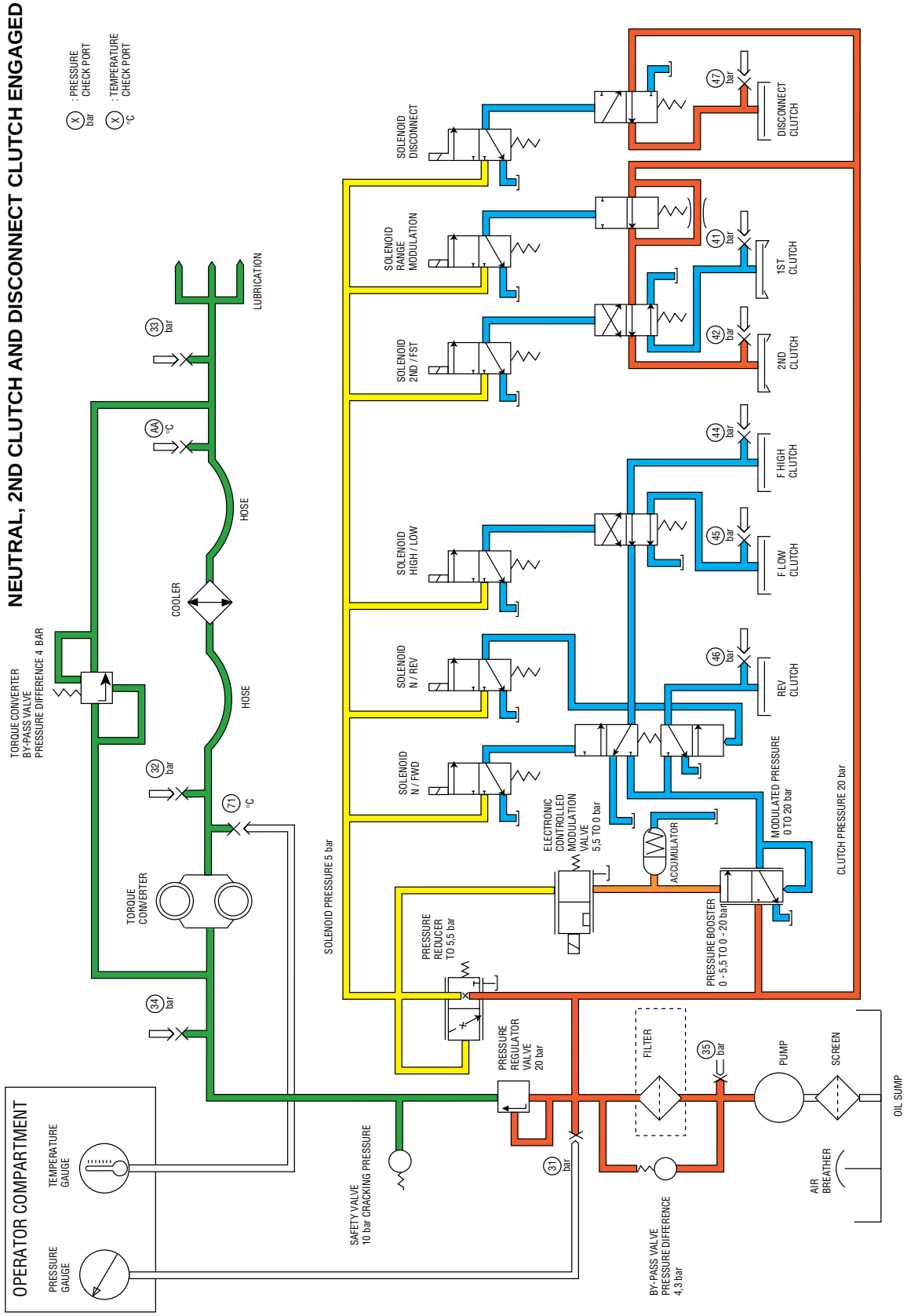
• Minimum 19 mm internal diameter for lines and fittings.

• Suitable for operation from ambient to 120° C continuous operating temperature.

• Must withstand 20 bar continuous pressure and with 40 bar intermittent surges.

• Conform SAE J1019 and SAE J517,100RI

NEUTRAL, 2ND CLUTCH AND DISCONNECT CLUTCH ENGAGED



OPERATION OF THE UNIT

The transmission and hydraulic torque converter of the power train enacts an important role in transmitting engine power to the driving wheels. In order to properly maintain and service these units it is important to first understand their function and how they operate.

A. THE HYDRAULIC CIRCUIT (REFER TO HYDRAULIC DIAGRAM)

The transmission and torque converter function together and operate through a common hydraulic system.

With the engine running, the transmission charging pump draws oil through the oil suction screen and directs it through the oil filter and pressure regulating valve.

Across the oil filter is a filter by pass valve which will open if the pressure difference becomes higher than 4,3 bar (62 PSI).

The pressure regulating valve maintains pressure for the control valve and clutches at 20 bar (288 PSI).

Excess oil volume is bled off into the converter circuit. A safety valve is fitted between the pressure regulator and converter. The valve will open if pressure in this line becomes higher than 10 bar (144 PSI).

After entering the converter the oil is directed through the converter blade cavity and exits in the passage between the turbine shaft and pump drive shaft and flows to the cooler.

After leaving the cooler the oil is directed to a fitting on the transmission. Then through a series of tubes and passages lubricates and cools the transmission bearings and clutches.

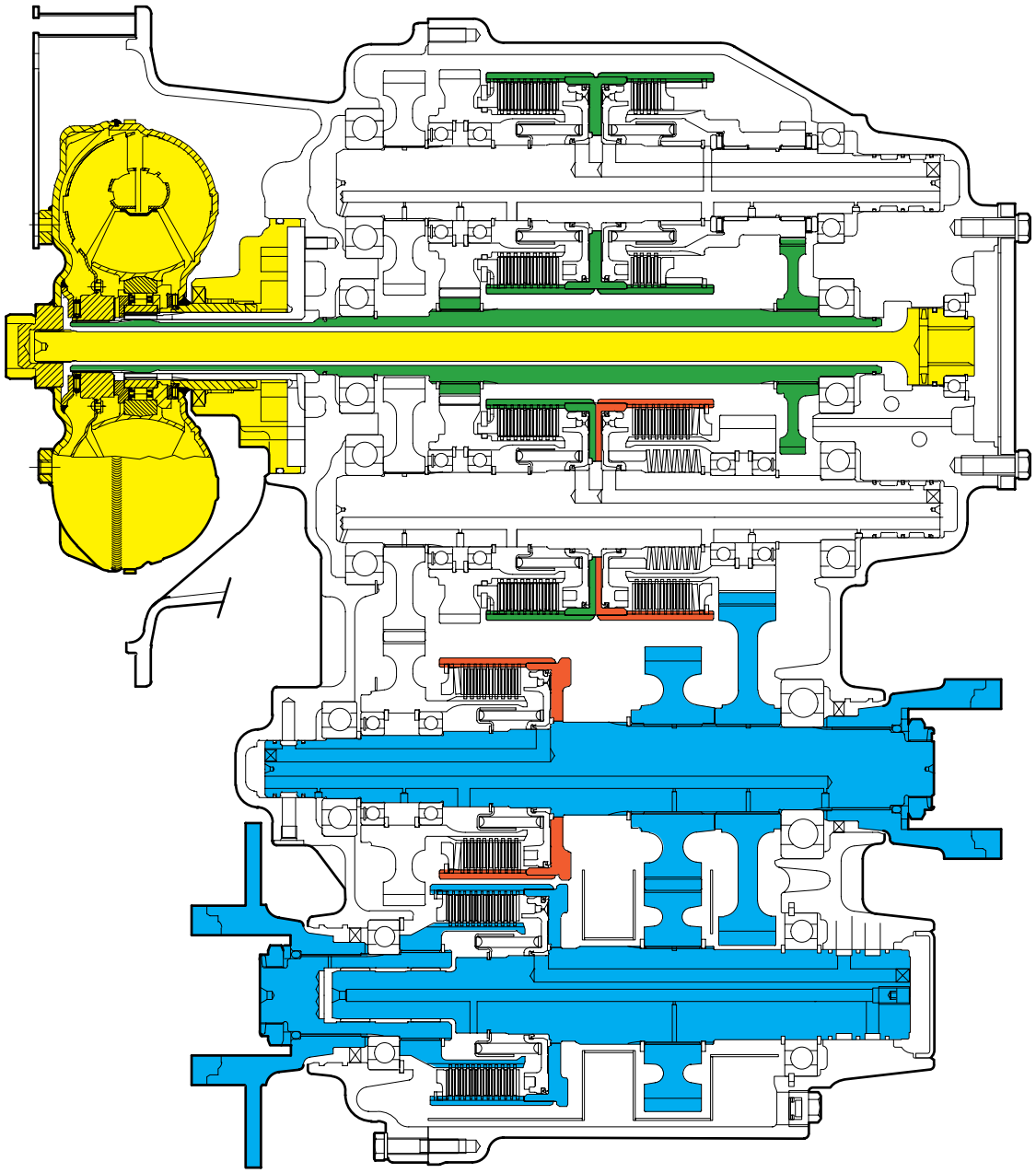
The oil then gravity drains back to the transmission sump.

Across the converter and oil cooler is a converter by pass valve which will open if the pressure difference is higher than 4 bar (58 PSI) (during start up from cold or at high RPM).

B. THE TRANSMISSION ASSEMBLY

Basically the transmission is composed of five main assemblies:

1. The converter and pump drive section.
2. The input or directional clutches.
3. The range clutches.
4. The output section.
5. The transmission controls.



1. The converter and pump drive section

Engine power is transmitted from the engine flywheel to the impeller through the impeller cover.

This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump in that it picks up fluid at its centre discharges at its outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the turbine shaft or directional clutch shaft. This element receives fluid at its outer diameter and discharges at its centre.

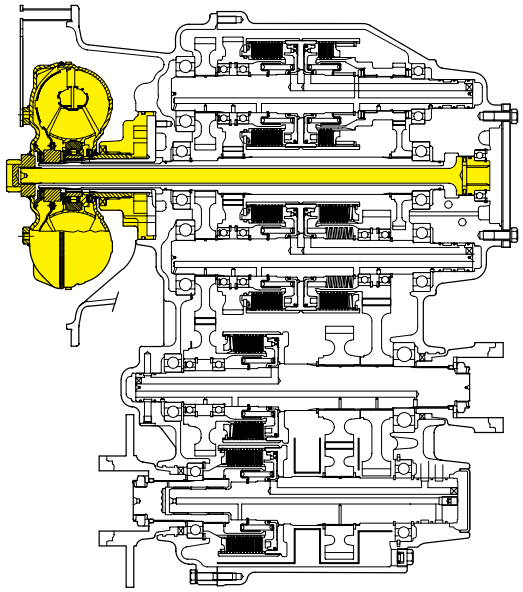
The reaction member of the torque converter is located between and at the centre of the inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element. This recirculation will make the converter to multiply torque.

The torque multiplication in function of the balding (impeller, turbine and reaction member) and the converter output speed (turbine speed). The converter will multiply engine torque to its designed maximum multiplication ratio when the turbine shaft is at zero RPM (stall).

Therefore we can say that as the turbine shaft is decreasing in speed, the torque multiplication is increasing.

In the impeller cover a splined shaft is fitted which runs inside and through the turbine shaft to drive a hydraulic pump which is fitted at the back of the transmission. Since the shaft is connected to the centre of the impeller cover, the pump speed will be the same as engine speed.

The rear side of the impeller cover has a tanged drive which drives the transmission charging pump located in the converter housing. The transmission charging pump speed is also the same as the engine speed.



The convertor and pump drive section

2. The input or directional clutches

The turbine shaft driven from the turbine transmits power to the forward or reverse clutches.

These clutches consists of a drum with splines and a bore to receive a hydraulic actuated piston. The piston is oil tight by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc with splines at the inner diameter is inserted. Discs are alternated until the required total is achieved.

A back up plate is then inserted and secured with a span ring. A hub with outer diameter splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, the control valve which is fitted on the side of the transmission will direct oil under pressure through tubes and passages to the selected clutch shafts.

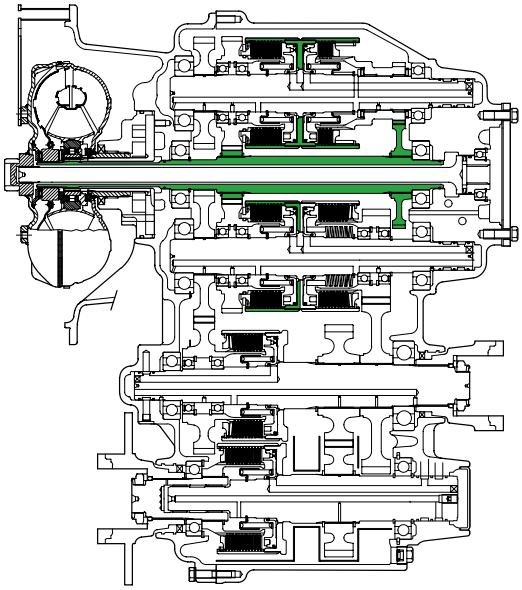
Oil sealings are located on the clutch shafts. These rings direct the oil through a drilled passage in the shaft to the desired clutch.

Pressure of the oil forces the piston and discs against the back up plate. The discs with splines on the outer diameter clamping against discs with teeth on the inner diameter enables the drum and hub to be locked together and allows them to drive as one unit.

When the clutch is released, a return spring will push the piston back and oil will drain back via the control valve into the transmission sump.

The T16000 transmission has one reverse clutch and two forward clutches (forward low and forward high). This in combination with the two range clutches result in the transmission having 4 forward speeds and 2 reverse speeds.

The engagement of the directional clutches is modulated; which means that clutch pressure is built up gradually. This will enable the unit to make forward, reverse shifts while the vehicle is still moving and will allow smooth engagement of drive. The modulation is controlled electronically in the control valve.



The input or directional clutches

3. The range clutches

Once a directional clutch is engaged power is transmitted to the range clutches (1st or 2nd).

Operation and actuation of the range clutches is similar as the directional clutches.

The engagement of the range clutches is also modulated to enable a smooth engagement.

The modulation for these clutches is achieved by means of a restrictor valve fitted in the control valve which is controlled electronically and which limits oil flow to the clutch during shifts. In the clutch itself the plate before the end plates is dished to build up the clamping force of the clutch gradually.

4. The output section

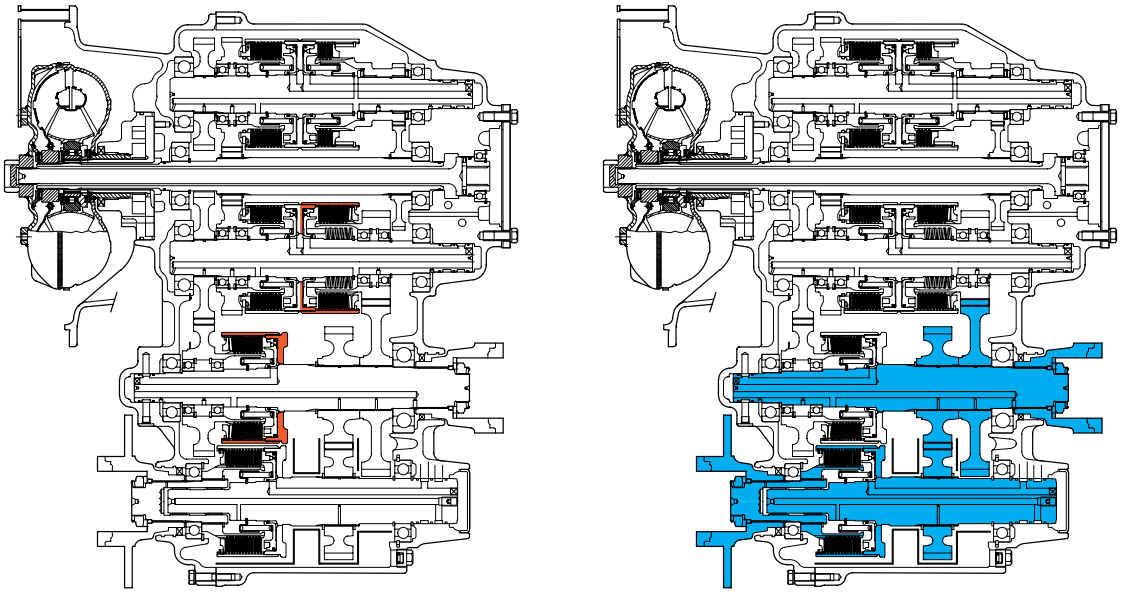
With a range clutch engaged power is finally transmitted to the output shafts.

The T16000 transmission can have an upper output or lower output at the rear side of the unit, and a lower output at the front side. Output rotation of the rear upper output is opposite the engine rotation when the forward clutch is engaged, while output rotation of the lower rear output and the front output is the same as the engine rotation with the forward clutch engaged.

Ration between upper and lower output is 0,951:1.

The lower front output has an axle disconnect clutch to enable 4 wheel drive.

The clutch is similar as the other clutches except that it has no modulation. The disconnect is controlled electronically. Without an electrical signal the clutch is always engaged.



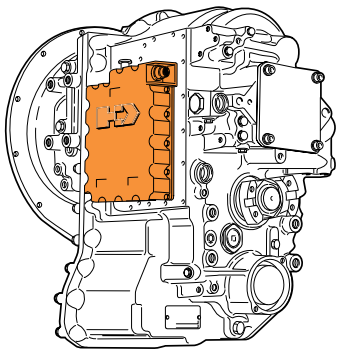
The range clutches

The output section

5. The transmission controls (refer to hydraulic diagram)

The transmission is controlled by an electronic gear selector (EGS). This unit has a microprocessor which receives certain inputs (gear selector position, speed sensor, ...) which are processed and will give output signals to the control valve.

The control valve has 6 solenoid, 6 shift spools, a pressure reducer, an electronic controlled modulation valve, an accumulator, a pressure booster and a speed sensor.



The transmission controls

Operation of the valve is as follows:

Regulated pressure 20 bar (290 PSI) is directed to the shift spools, pressure booster and pressure reducer.

In the pressure reducer, regulated pressure is reduced to 5,5 bar (80 PSI). This reduced pressure is used as supply for the solenoid and electronic controlled modulation valve.

When activated, the electronic controlled modulation valve will give an output pressure curve from 0 to 5 bar (0 to 80 PSI).

This pressure curve is multiplied in the booster so that a curve from 0 to 20 bar (0 to 290 PSI) is available for the directional clutches. Between the electronic modulation valve and the booster is an accumulator to damper any hydraulic vibration.

When forward is selected the electronic modulation valve and the forward solenoid are activated. The pilot pressure of the forward solenoid will move the shift spool so that a forward clutch can be fed with modulated pressure.

If the high/low solenoid is not activated the forward high clutch is engaged, if it is activated the forward low clutch is engaged.

When reverse is selected the electronic modulation valve and the reverse solenoid are activated, the pilot pressure of the reverse solenoid will move the shift spool so that the reverse clutch can be fed with modulated pressure.

The shift spools from forward and reverse are located against each other with a return spring in between; this is to make sure that only one direction can be selected.

Range is selected as follows:

If the range solenoid (2nd / 1st) is not activated, regulated pressure is fed through the modulation shift spool and through the 2nd / 1st shift spool to the 2nd clutch.

If the range solenoid (2nd / 1st) is activated, the pilot pressure will move the shift spool so that 1st clutch is fed.

The range clutches also have modulation which operates as follows:

When the range is changed, oil will flow through the modulation shift spool to the chosen range clutch momentary until the friction discs are closed against the dished plate. At that moment the range modulation solenoid is activated.

The plot pressure will move the modulation shift spool so that oil supply is fed through a restrictor which is in by pass of the valve.

The controlled volume of oil is used to push in the dished outer plate gradually until the clutch is fully closed. This will give a smooth build up of torque. At that moment the range modulation solenoid is released, so that the modulation shift spool return to its rest position and allowing full oil flow to the clutch.

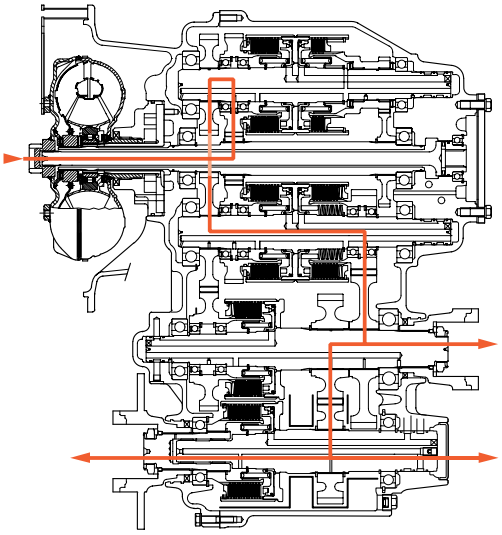
The control valve also controls the front lower output disconnect clutch. If the solenoid is not activated full oil pressure is fed through the disconnect shift spool to the disconnect clutch. If the solenoid is activated, pilot pressure will move the disconnect shift spool to block oil supply to the disconnect clutch to release it.

The control valve also has a speed sensor. This sensor will pick up upper output gear speed. This information is used in the electronic gear selector to determine shift logic. Since the sensor picks up upper output gear speed, the signal will be in direct relation of the turbine speed if any directional clutch is engaged.

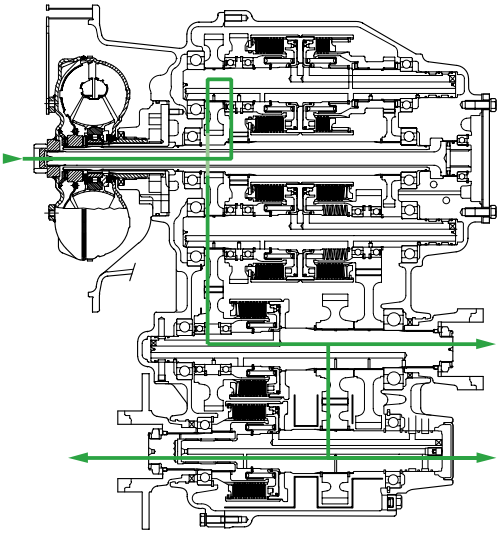
C. ELECTRIC SOLENOID CONTROLS

Transmission gear	Activated solenoids	Activated clutches
Forward 4	Forward	Forward high, 2nd
Forward 3	Forward, 2nd / 1st	Forward high, 1st
Forward 2	Forward, Forward high / low	Forward low, 2nd
Forward 1	Forward, Forward high / low, 2nd / 1st	Forward low, 1st
Reverse 1	Reverse, 2nd / 1st	Reverse, 1st
Reverse 2	Reverse	Reverse, 2nd
Disconnect off	Disconnect	----------
Disconnect on	----------	Disconnect

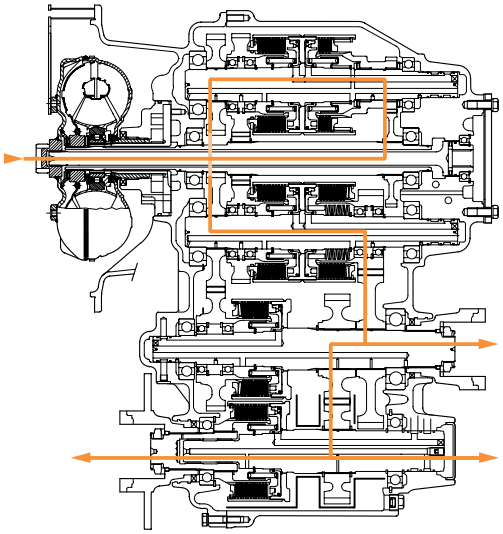
D.POWER FLOWS



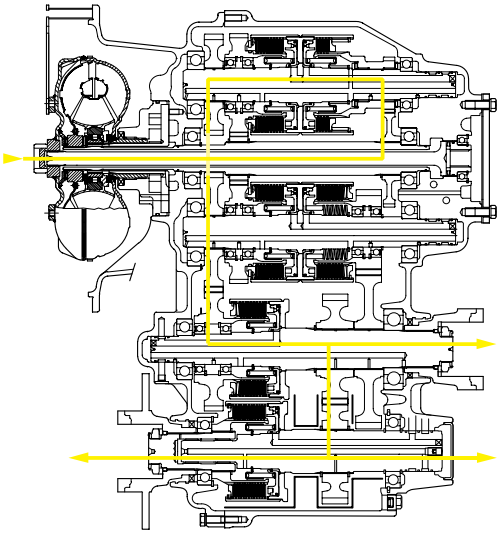
1st SPEED FORWARD



2nd SPEED FORWARD

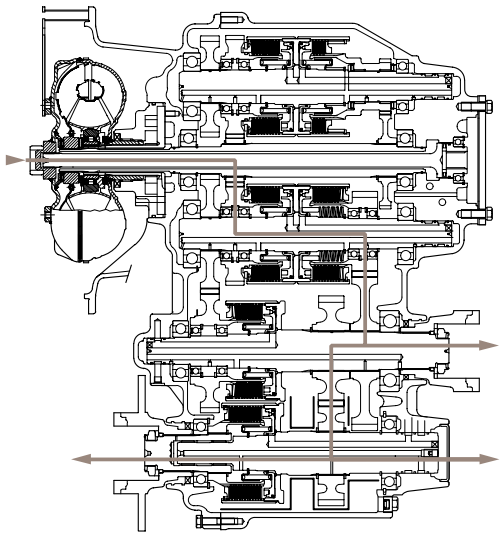


3rd SPEED FORWARD

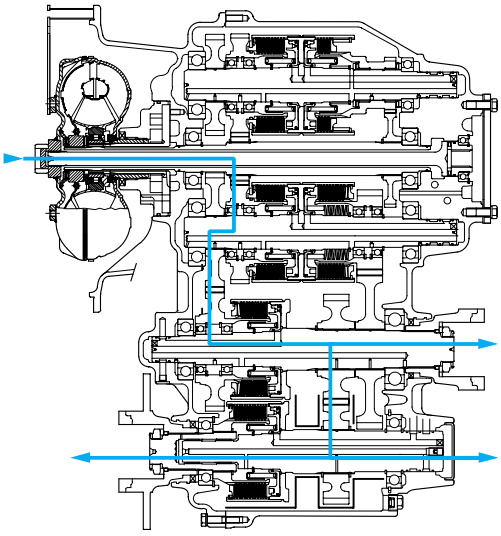


4th SPEED FORWARD

D. POWER FLOWS

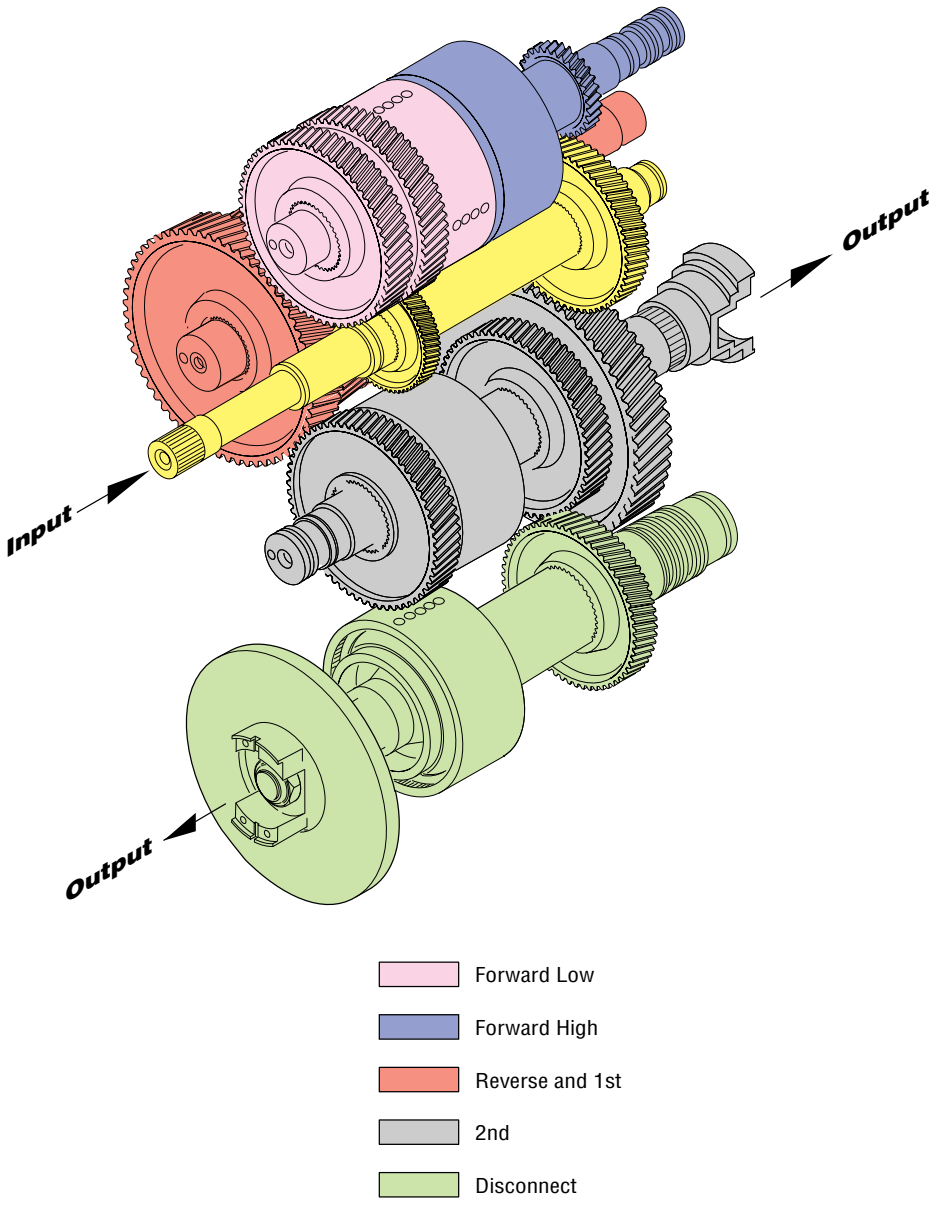


1st SPEED REVERSE



2nd SPEED REVERSE

E. GEAR AND CLUTCH LAY-OUT



TROUBLESHOOTING GUIDE FOR THE T16000 TRANSMISSION

The following information is presented as an aid to isolating and determining the specific problem area in a transmission that is not functioning correctly.

When troubleshooting a “transmission” problem, it should be kept in mind that the transmission is only the central unit of a group of related powertrain components. Proper operation of the transmission depends on the condition and correct functioning of the other components of the group. Therefore, to properly diagnose a suspected problem in the transmission, it is necessary to consider the transmission fluid, charging pump, torque converter, transmission assembly, oil cooler, filter, connecting lines, and controls, including the engine, as a complete system.
By analyzing the principles of operation together with the information in this section, it should be possible to identify and correct any malfunction which may occur in the system.

T16000 TRANSMISSION

T16000 (power shift with torque converter transmission) troubles fall into three general categories: mechanical hydraulic and electrical problems.
In addition to the mechanical and electrical components, all of which must be in the proper condition and functioning correctly, the correct functioning of the hydraulic circuit is most important. Transmission fluid is the “life blood” of the transmission. It must be supplied in an adequate quantity and delivered to the system at the correct pressures to ensure converter operation, to engage and hold the clutches from slipping, and to cool and lubricate the working components.

TROUBLESHOOTING PROCEDURES

Stall Test:

Use a stall test to identify transmission, converter, or engine problems.

Transmission pressure checks:

Transmission problems can be isolated by the use of pressure tests. When the stall test indicates slipping clutches, then measure clutch pack pressure to determine if the slippage is due to low pressure or clutch plate friction material failure.
In addition, converter charging pressure and transmission lubrication pressure may also be measured.

Mechanical and electrical checks:

Prior to checking any part of the system for hydraulic function (pressure testing), the following mechanical and electrical checks should be made:

- Check the parking brake for correct adjustment.
- Be sure all lever linkage is properly connected and adjusted in each segment and at all connecting points.
- The controls are actuated electrically. Check the wiring and electrical components.
- Be sure that all components of the cooling system are in good condition and operating correctly. The radiator must be clean to maintain the proper cooling and operating temperatures for the engine and transmission. Air clean the radiator, if necessary.
- The engine must be operating correctly. Be sure that it is correctly tuned and adjusted to the correct idle and maximum no-load governed speed specifications.

Hydraulic check:

Also, before checking the transmission clutches, torque converter, charging pump, and hydraulic circuit for pressure and rate of oil flow, it is important to make the following transmission fluid check:
Check oil level in the transmission. The transmission fluid must be at the correct (full level). All clutches and the converter and its fluid circuit lines must be fully charged (filled) at all times. See NOTE below.

NOTE: The transmission fluid must be at operating temperature of 82 - 93° C (180 - 200 F) to obtain correct fluid level and pressure readings.
DO NOT ATTEMPT TO MAKE THESE CHECKS WITH COLD OIL.

To raise the oil temperature to this specification it is necessary to either operate (work) the vehicle or run the engine with converter at "stall". (Refer to converter stall procedure).

CAUTION: Be careful that the vehicle does not move unexpectedly when operating the engine and converter at stall R.P.M.

A. CONVERTER STALL PROCEDURE

1. Put the vehicle against a solid barrier, such as a wall, and/or apply the parking brake and block the wheels.
2. Put the directional control lever in FORWARD (or REVERSE, as applicable).
3. Select the highest speed.
   With the engine running, slowly increase engine speed to approximately one-half throttle and hold until transmission (converter outlet) oil temperature reaches the operating range.

CAUTION: Do not operate the converter at stall condition longer than 30 seconds at one time, shift to neutral for 15 seconds and repeat the procedure until desired temperature is reached. Excessive temperature (120° C) 250 F maximum) will cause damage to transmission clutches, fluid, converter, and seals.

TROUBLESHOOTING GUIDE

Refer to the following troubleshooting guide for the diagnosis of typical transmission troubles.

LOW CLUTCH PRESSURE

CAUSE	REMEDY
1. Low oil level	1. Fill to proper level
2. Clutch pressure regulating valve stuck open	2. Clean valve spool and housing
3. Faulty charging pump	3. Replace pump
4. Broken or worn clutch shaft or piston sealing rings	4. Replace sealing rings

LOW CHARGING PUMP OUTPUT

CAUSE	REMEDY
1. Low oil level	1. Fill to proper level
2. Suction screen plugged	2. Clean section pump
3. Defective charging pump	3. Replace pump

OVERHEATING

CAUSE	REMEDY
1. Worn oil sealing rings	1. Remove, disassemble, and rebuild converter assembly
2. Worn charging pump	2. Replace
3. Low oil level	3. Fill to proper level
4. Dirty oil cooler	4. Clean cooler
5. Restriction in cooler lines	5. Change cooler lines

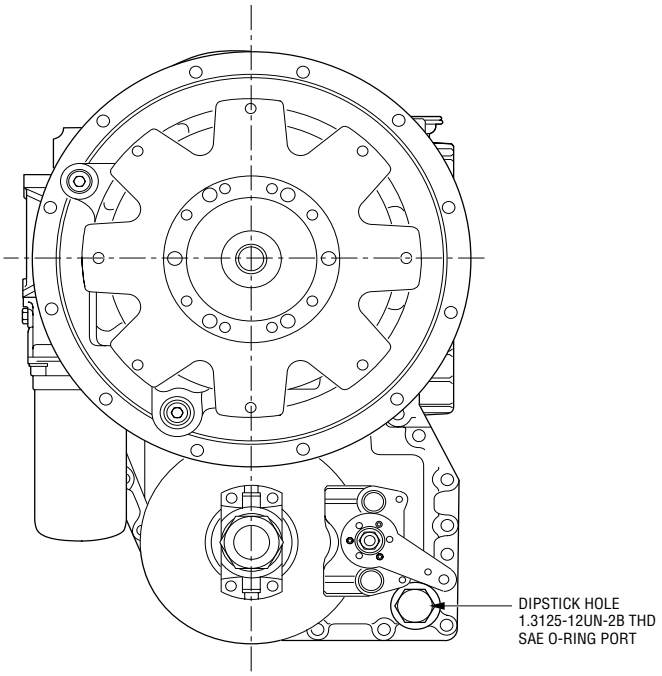
NOISY CONVERTER

CAUSE	REMEDY
1. Worn charging pump	1. Replace
2. Worn or damaged bearings	2. A complete disassembly will be necessary to determine what bearing is faulty

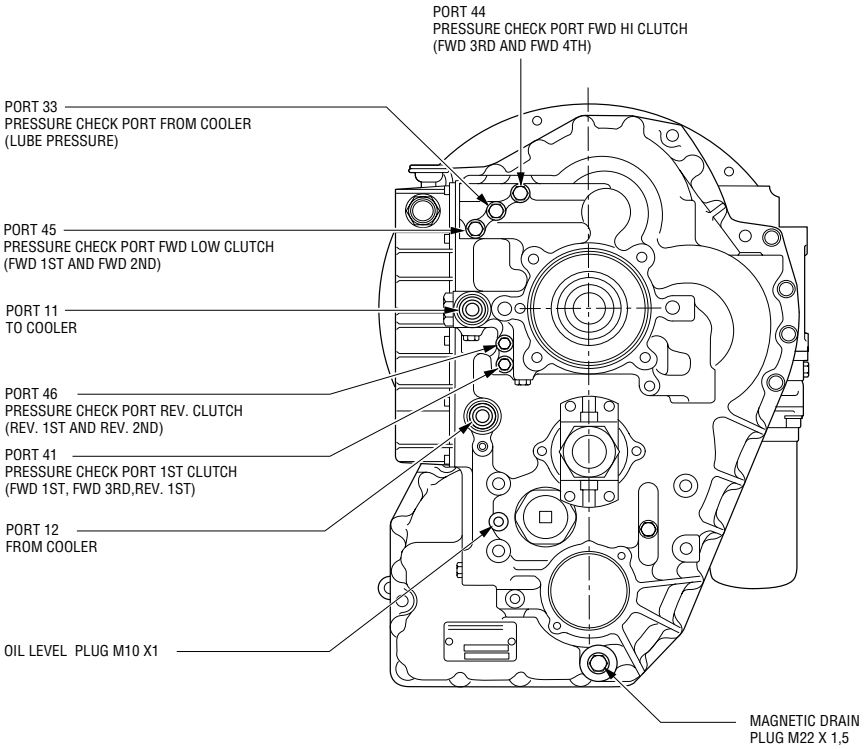
LACK OF POWER

CAUSE	REMEDY
1. Low engine R.P.M. at converter stall	1. Tune engine check governor
2. See “Overheating” and make same checks	2. Make corrections as explained in “Overheating”

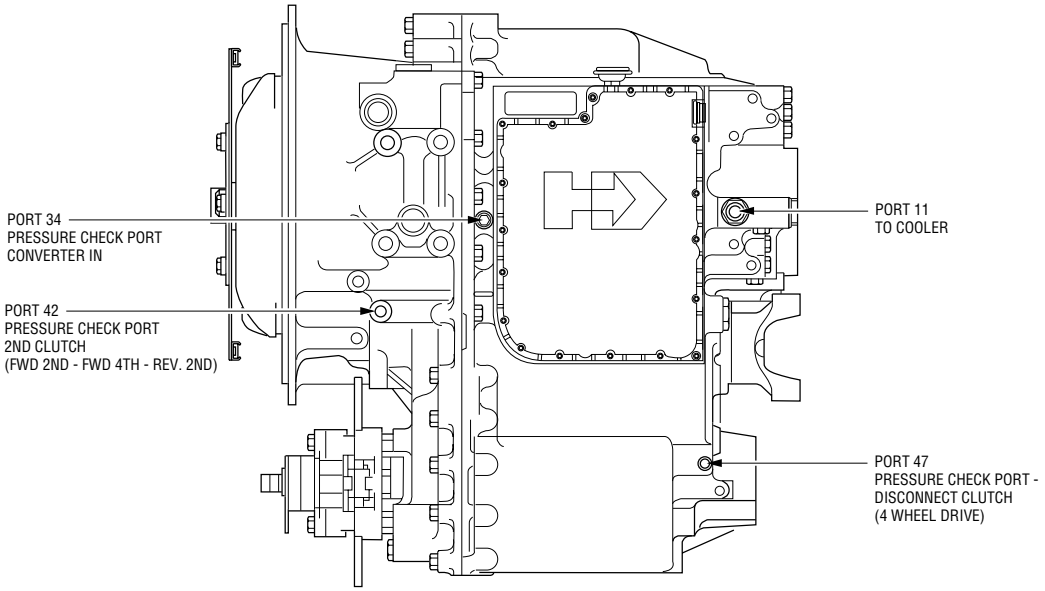
B. CHECK POINTS



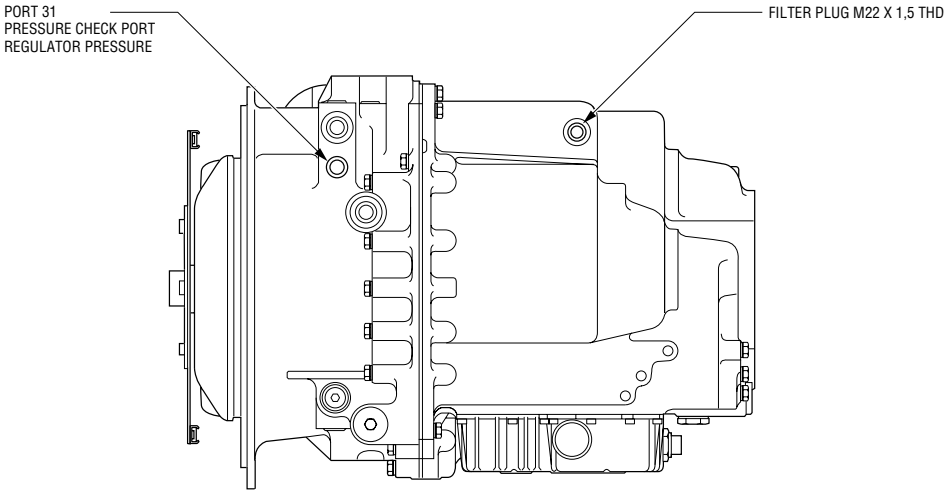
FRONT VIEW



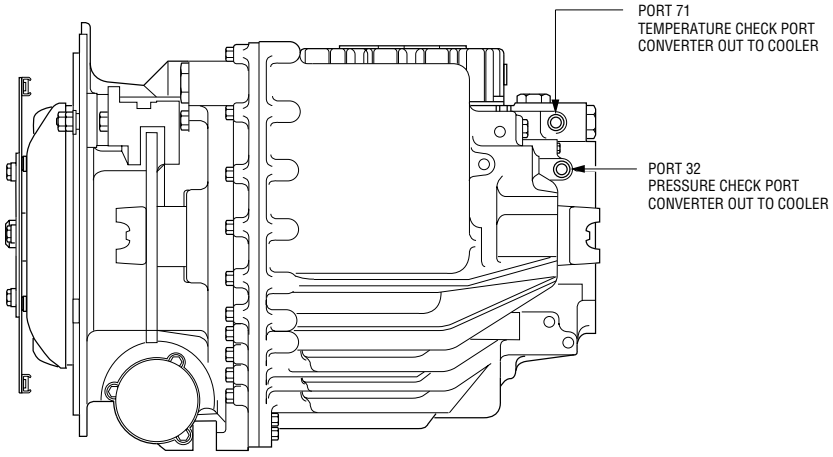
REAR VIEW



LEFT SIDE VIEW



TOP VIEW



BOTTOM VIEW

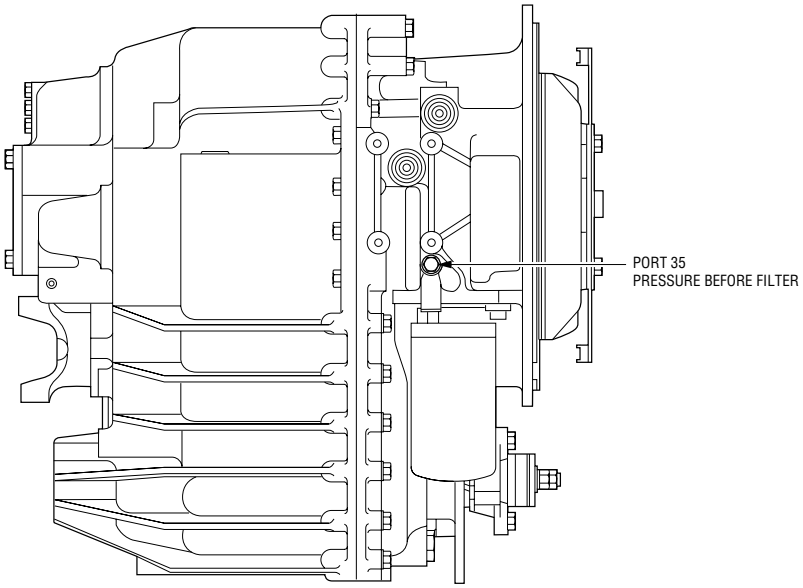
Threads

All pressure and temperature check ports:

- M10 x 1 THD
  o-ring port ISO 6149-1

All hydraulic line connection ports:

- 1,0625-12 UN 2B
  SAE-o-ring port

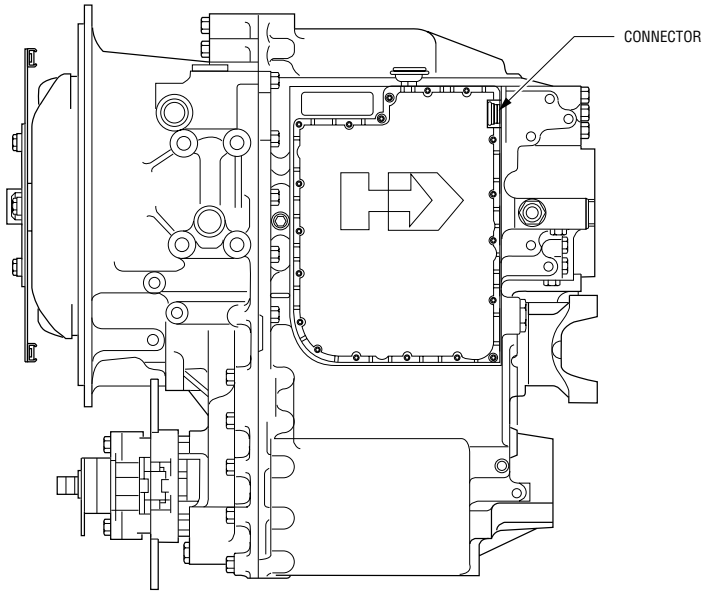


RIGHT SIDE VIEW

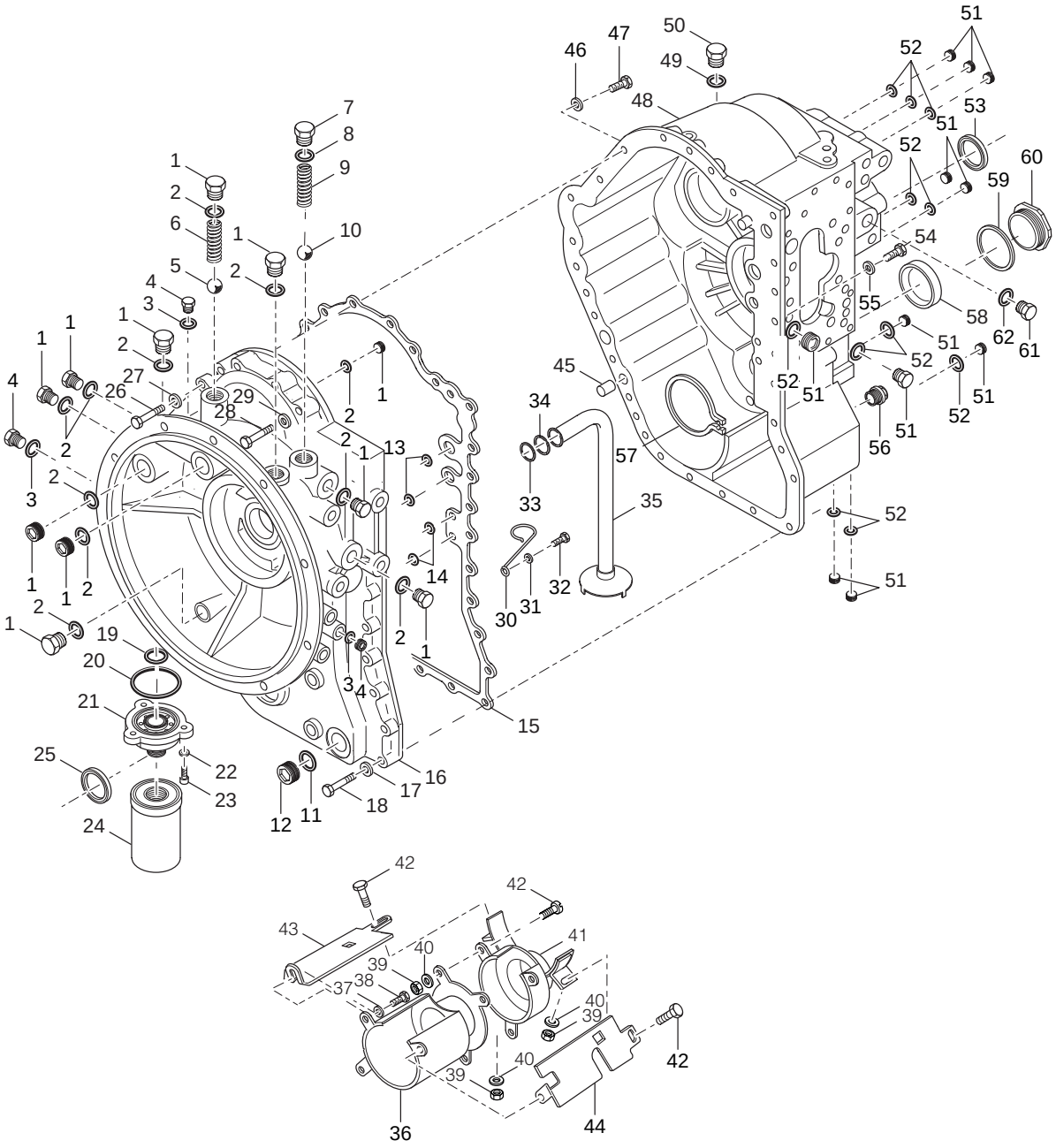
C. ELECTRICAL WIRING

Transmission Control valve connections

Wire	Pin	Function
CV04	M	Control valve common plus (+) for direction and range modulation solenoid
CV05	L	Transmission temperature out (+)
CV06	K	Range modulation solenoid (-)
CV07	J	Speed-sensor/Temp-sensor ground (-)
CV08	H	Control valve common ground (-) for forward, reverse,1/2,high/low and disconnect solenoid
CV09	G	Direction modulation solenoid (-)
CV10	F	Reverse / neutral solenoid (+)
CV11	E	Disconnect solenoid (+)
CV12	D	Range 1/2 solenoid (+)
CV13	C	Forward / neutral solenoid (+)
CV14	B	Forward lo/hi solenoid (+)
CV15	A	Speed sensor + output (+)



SECTIONAL VIEWS AND PARTS IDENTIFICATION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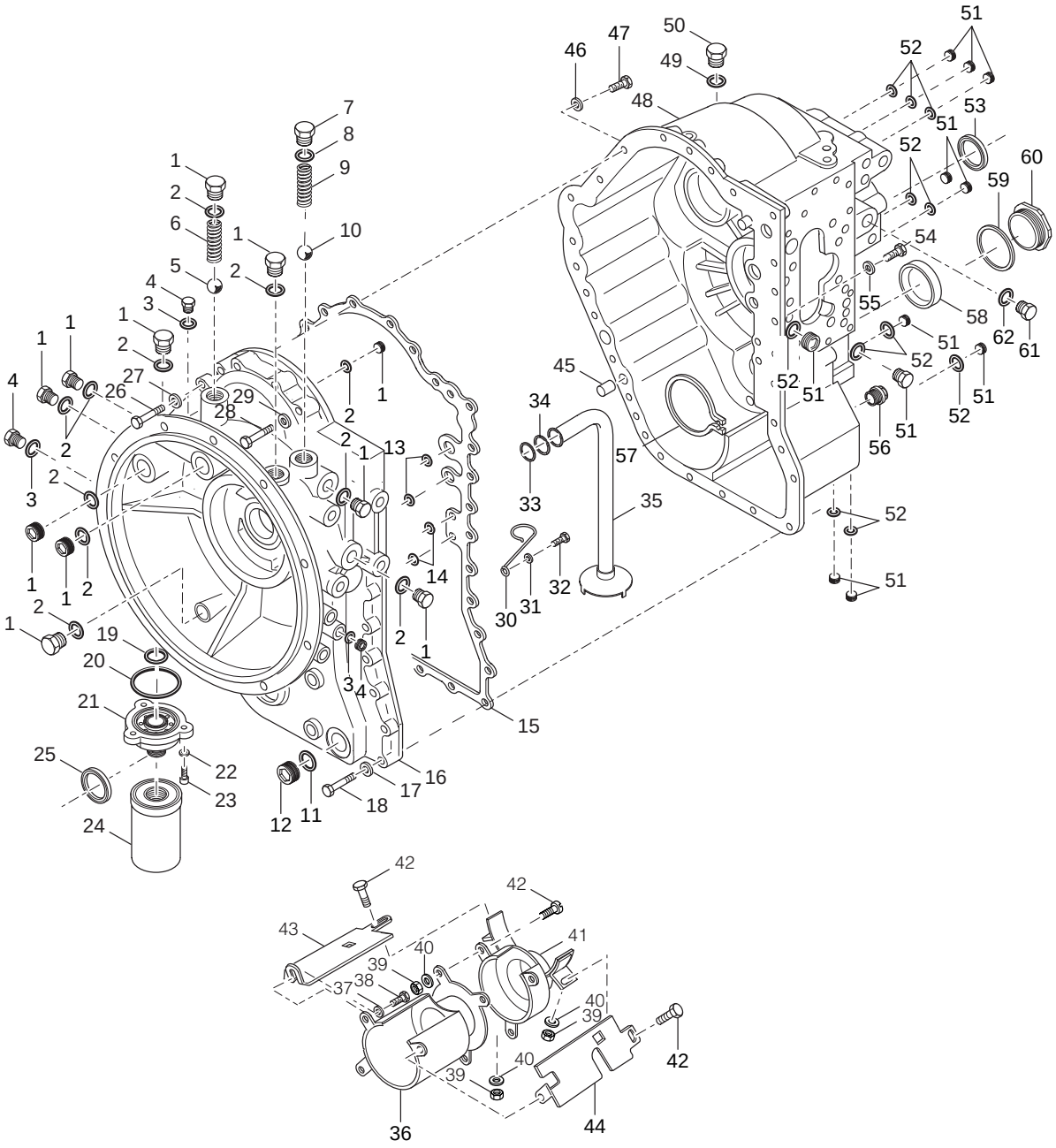
Item	Description	Quantity
1	Plug	11
2	“O” ring plug	11
3	“O” ring plug	3
4	Plug	3
5	Ball	1
6	Spring	1
7	Plug	1
8	“O” ring plug	1
9	Spring safety valve	1
10	Ball	1
11	“O” ring plug	1
12	Plug	1
13	“O” ring - converter housing to transmission case	2
14	“O” ring - converter housing to transmission case	2
15	Gasket - converter housing to tranmission case	1
16	Housing - converter	1
17	Lockwasher - converter housing to transmission case screw	14
18	Screw - converter housing to transmission case	14
19	“O” ring - filter adaptor	1
20	“O” ring - filter adaptor	1
21	Filter - adaptor	1
22	Lockwasher - filter adaptor screw	3
23	Screw - filter adaptor	3
24	Assembly - filter	1
25	Oil seal - output shaft front	1
26	Screw - converter housing to transmission case	1
27	Lockwasher - converter housing to transmission case screw	1
28	Screw - converter housing to transmission case	5
29	Lockwasher - converter housing to transmission case screw	5
30	Clip - suction tube	1
31	Lockwasher - suction tube screw	1
32	Screw - suction tube	1
33	“O” ring - suction tube	1
34	Retainer - suction tube	1
35	Assembly - tube & screen	1
36	Baffle - oil	1
37	Lockwaher - oil baffle mountng screw	3
38	Screw - oil baffle mounting	3
39	Nut - oil baffle mounting screw	5
40	Lockwasher - oil baffle mounting screw	5
41	Baffle - oil	1
42	Screw - oil baffle mounting	5
43	Plate - oil baffle	1
44	Plate - oil baffle	1
45	Pin - transmission case to converter dowel	2
46	Lockwasher - converter housing to transmission case screw	4
47	Screw - converter housing to transmission case	4
48	Case - transmission	1
49	“O” ring plug	1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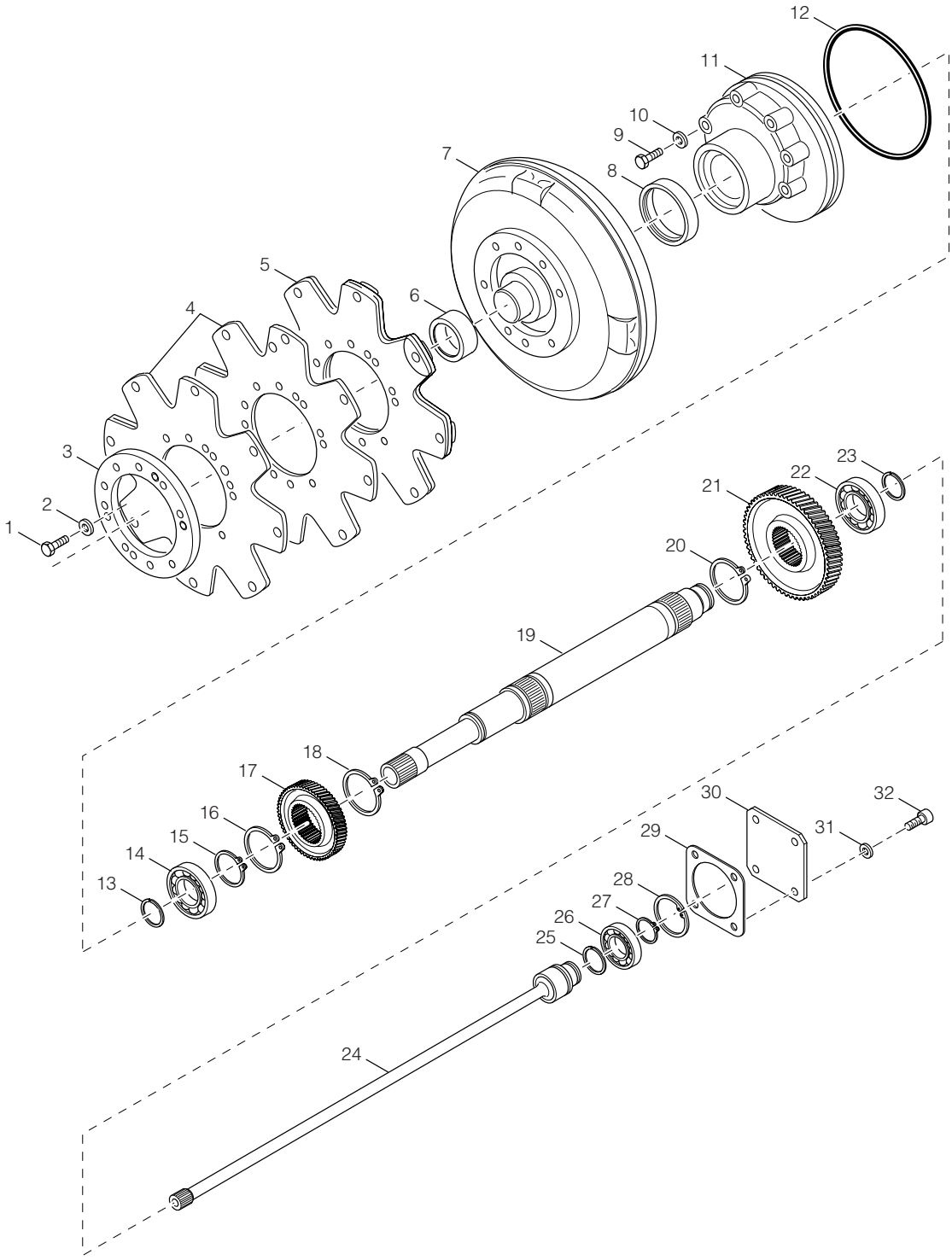
Item	Description	Quantity
50	Plug	1
51	Plug	11
52	“O” ring plug	11
53	Seal upper output	1
54	Screw - converter housing to transmission case	5
55	Lockwasher - converter housing to transmission case screw	5
56	Plug - magnetic drain	1
57	Snapring - output shaft rear bearing	1
58	Plug - output shaft bore	1
59	Sealing ring - plug	1
60	Plug	1
61	Plug	1
62	Plug	1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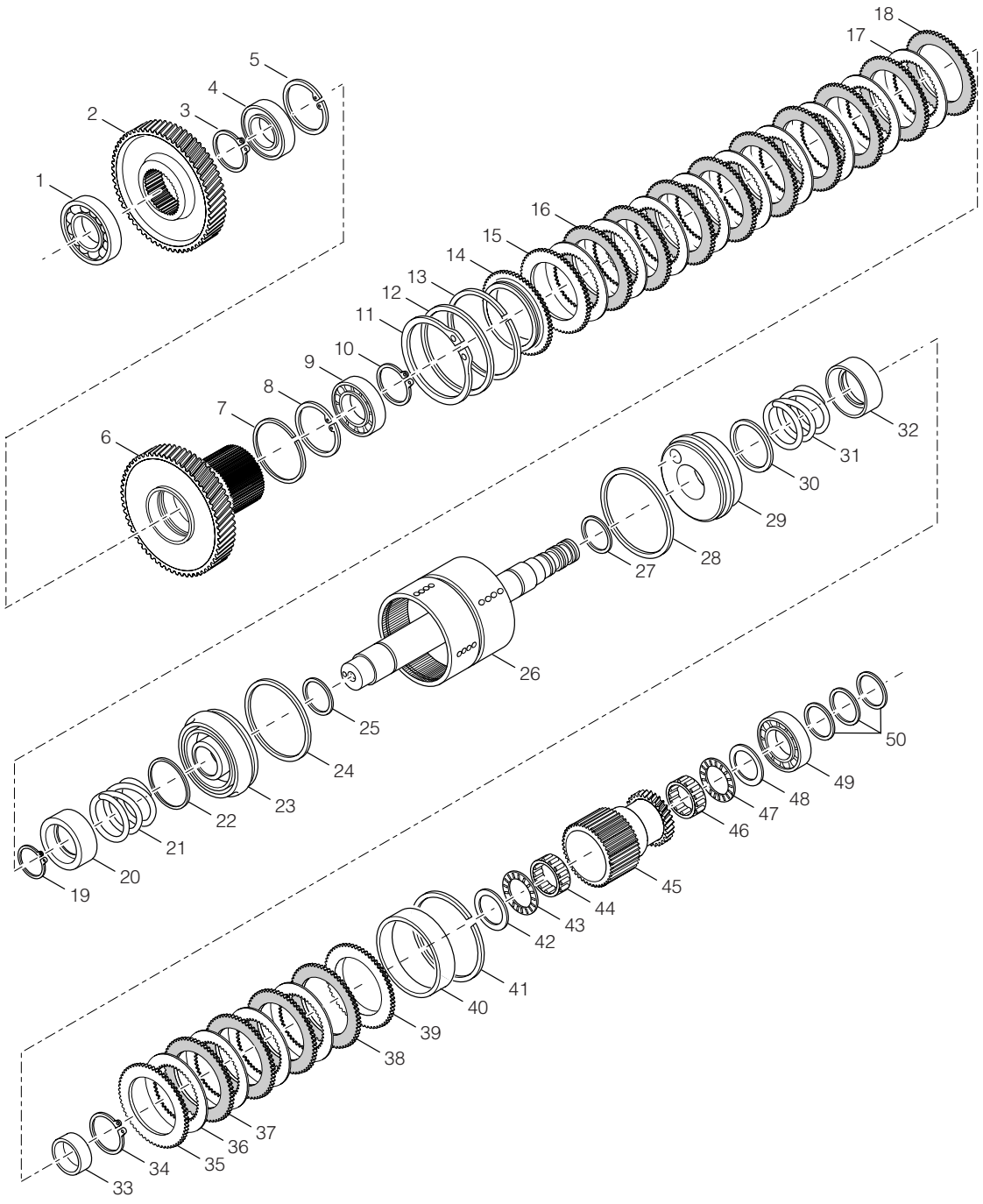
GROUP - INPUT SHAFT, TORQUE CONVERTER,PUMP DRIVE, INTERNAL CHARGING PUMP AND DRIVE PLATE

Item	Description	Quantity
1	Screw - drive plate mounting	6
2	Lockwasher - drive plate mounting screw	6
3	Ring - drive plate	1
4	Plate - drive	2
5	Assembly - drive plate	1
6	Bushing - converter pilot	1
7	Assembly - torque converter	1
8	Oil seal - charging pump	1
9	Screw - pump mounting	6
10	Seal washer - pump mounting screw	6
11	Assembly - charging pump	1
12	“O” ring - charging pump	1
13	Ring - piston	1
14	Bearing - input shaft front	1
15	Snap ring	1
16	Snap ring	1
17	Gear - forward low & reverse drive	1
18	Snap ring	1
19	Shaft - input	1
20	Snap ring	1
21	Gear - forward high drive	1
22	Bearing - input shaft rear	1
23	Ring - piston	1
24	Assembly - pump drive shaft & sleeve	1
25	Ring - piston	1
26	Bearing - pump drive shaft	1
27	Snap ring	1
28	Retaining ring	1
29	Gasket - permanent pump adapter cover	1
30	Cover - permanent pump adapter	1
31	Lockwasher - permanent pump adapter cover screw	4
32	Screw - permanent pump adapter cover	4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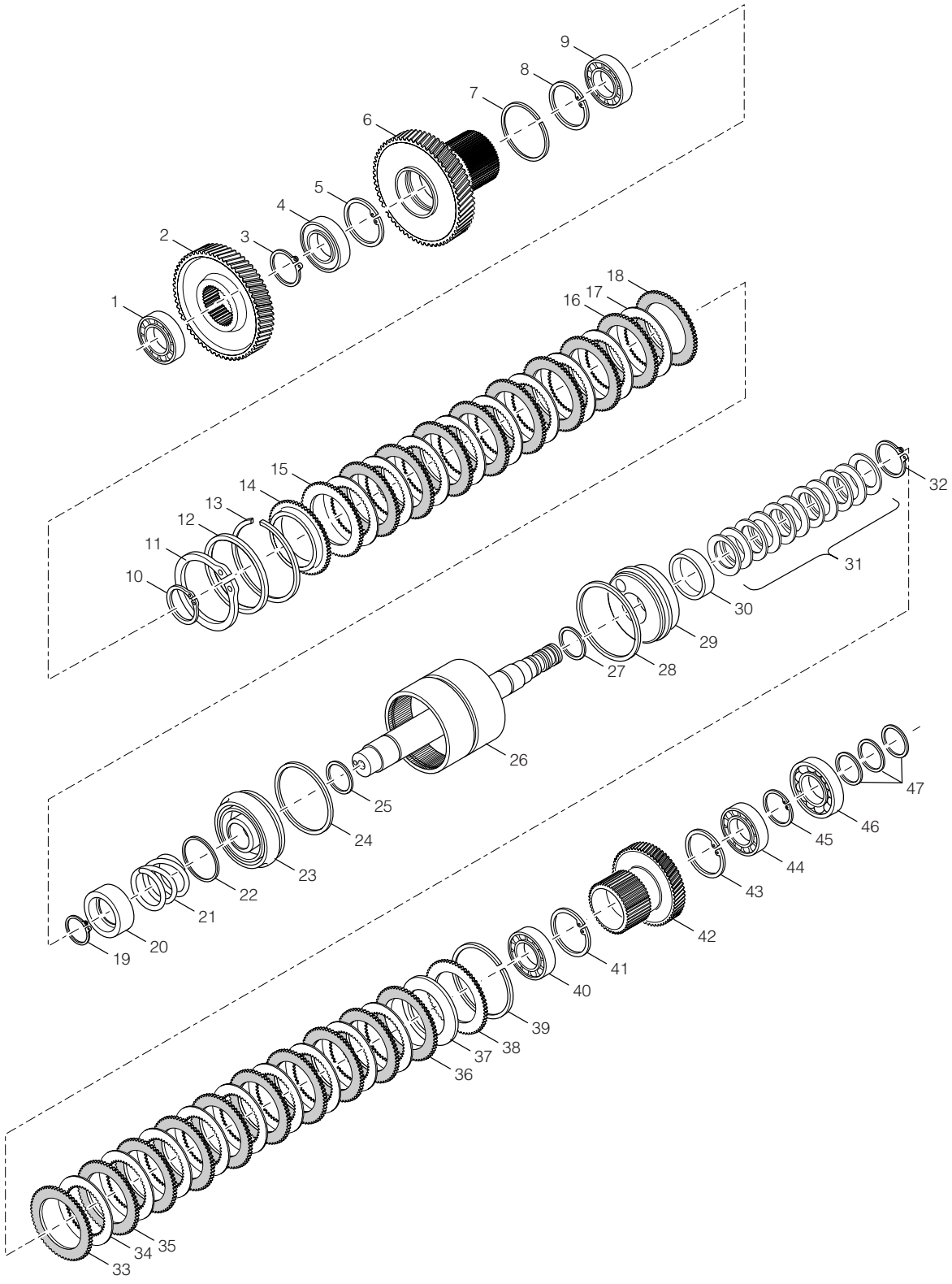
GROUP - FWD LOW/FWD HIGH SHAFT

Item	Description	Quantity
1	Bearing -front Fwd low / Fwd high shaft	1
2	Gear -forward driven	1
3	Snap ring	1
4	Bearing-clutch gear	1
5	Retaining ring-clutch gear bearing	1
6	Gear forward low clutch	1
7	Ring - clutch gear piston	1
8	Retaining ring - clutch gear bearing	1
9	Bearing - clutch gear	1
10	Snap ring	1
11	Snap ring	1
12	Washer	1
13	Snap ring-backing plate	1
14	Plate-clutch disc backing	1
15	Disc-outer half	1
16	Disc-outer	8
17	Disc-inner	9
18	Disc-outer half	1
19	Ring-retaining	1
20	Retainer spring	1
21	Spring-piston return	1
22	Plate spring-clutch piston wear	1
23	Assembly-clutch piston & seals	1
24	Seal-clutch piston-outer	1
25	Seal-clutch piston-inner	1
26	Assembly Fwd.low/Fwd.high,shaft drum & plug	1
27	Seal-clutch piston-inner	1
28	Seal-clutch piston-outer	1
29	Assembly clutch piston & seals	1
30	Plate spring clutch piston wear	1
31	Spring piston return	1
32	Retainer spring	1
33	Spacer clutch spring fwd high	1
34	Ring-retaining	1
35	Disc-outer half	1
36	Disc-inner	4
37	Disc-outer	3
38	Disc-outer half	1
39	Plate-clutch disc backing	1
40	Spacer-clutch disc backing plate Fwd/high	1
41	Snap ring spacer	1
42	Thrust washer	1
43	Thrust bearing	1
44	Bearing-needle	1
45	Gear-forward high clutch	1
46	Bearing-needle	1
47	Thrust bearing	1
48	Thrust washer	1
49	Bearing-rear Fwd low/Fwd high shaft	1
50	Ring-piston	3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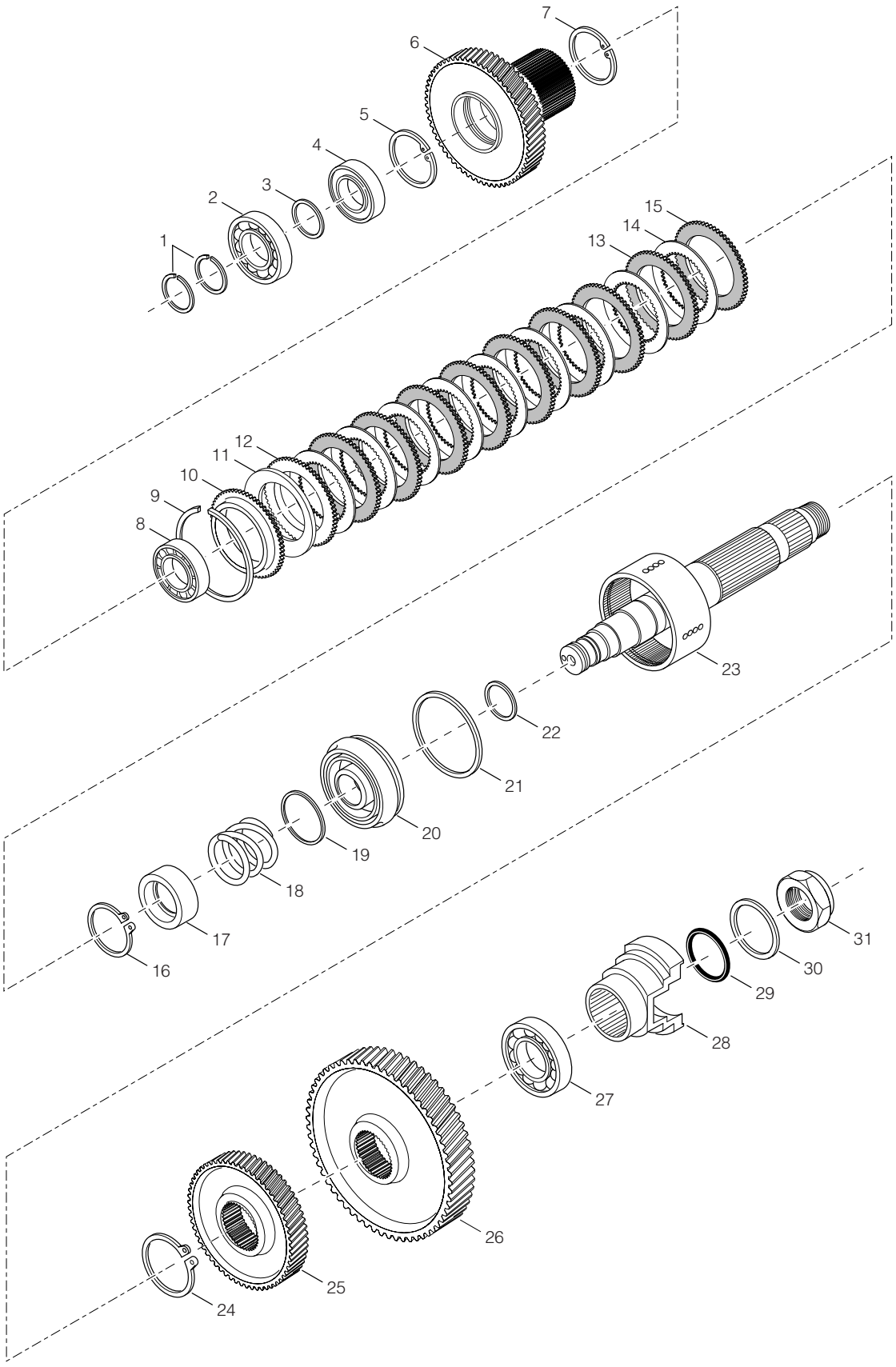
GROUP - REVERSE/1ST SHAFT AND GEARS

Item	Description	Quantity
1	Bearing -front Rev.:1st shaft	1
2	Gear -reverse driven	1
3	Snap ring	1
4	Bearing-clutch gear	1
5	Retaining ring-clutch gear bearing	1
6	Gear forward low clutch	1
7	Ring - clutch gear piston	1
8	Retaining ring - clutch gear bearing	1
9	Bearing - clutch gear	1
10	Snap ring	1
11	Snap ring	1
12	Washer	1
13	Snap ring-backing plate	1
14	Plate-clutch disc backing	1
15	Disc-outer half	1
16	Disc-outer	8
17	Disc-inner	9
18	Disc-outer half	1
19	Ring-retaining	1
20	Retainer spring	1
21	Spring-piston return	1
22	Plate spring-clutch piston wear	1
23	Assembly-clutch piston & seals	1
24	Seal-clutch piston-outer	1
25	Seal-clutch piston-inner	1
26	Assembly Rev./1st,shaft drum & plug	1
27	Seal-clutch piston-outer	1
28	Seal-clutch piston-inner	1
29	Assembly clutch piston & seals	1
30	Plate clutch piston wear	1
31	Assembly-spring disc	1
32	Ring-retaining	1
33	Disc-outer half	1
34	Disc-inner	9
35	Disc-outer	8
36	Disc-outer half	1
37	Modulation spring	1
38	Plate-clutch disc backing	1
39	Snap ring-clutch disc backing plate	1
40	Bearing clutch gear	1
41	Retaining ring-clutch gear bearing	1
42	Gear-1st clutch	1
43	Retaining ring - clutch gear bearing	1
44	Bearing clutch gear	1
45	Snap ring	1
46	Bearing-rear Rev./1st shaft	1
47	Ring-piston	3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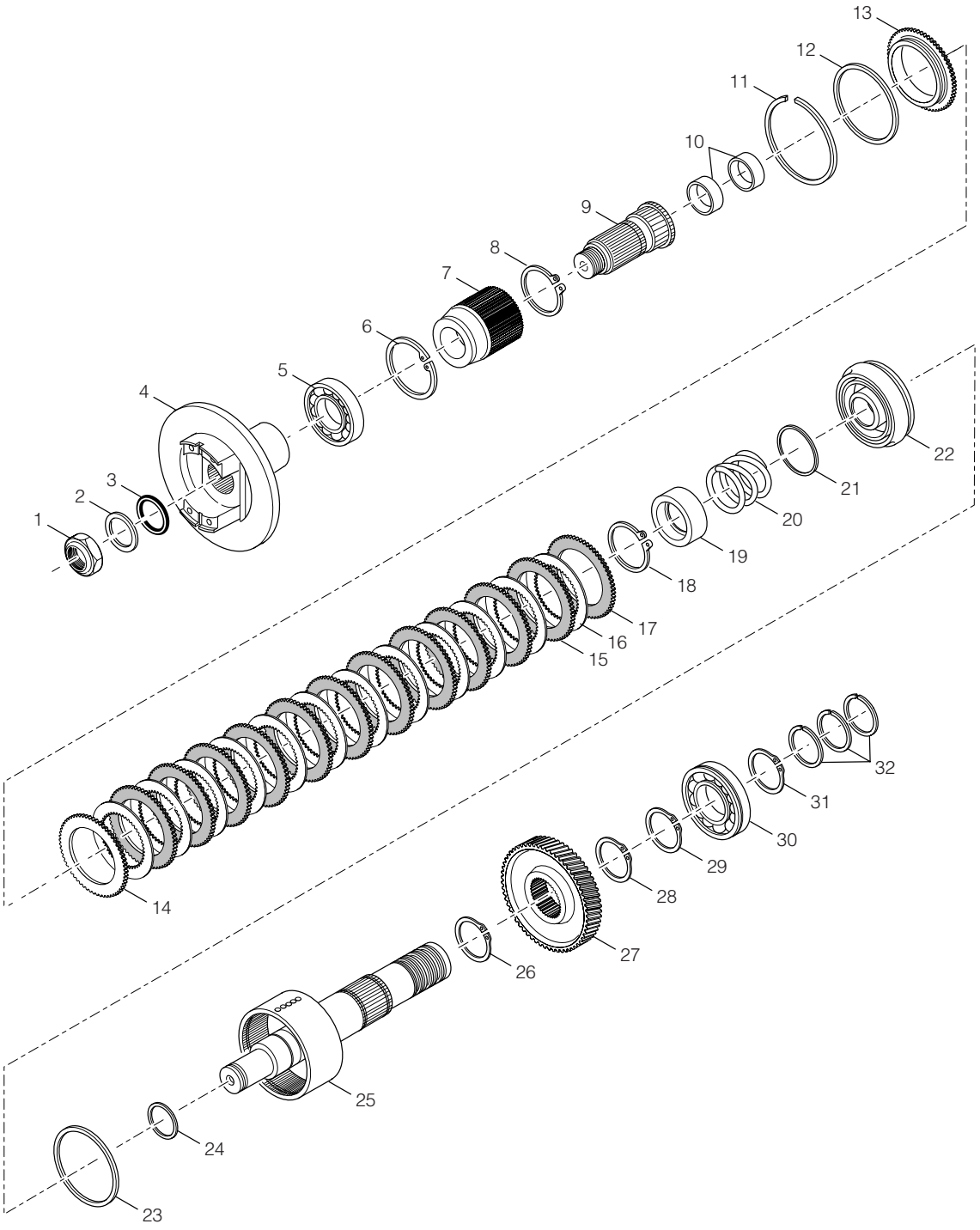
GROUP - 2ND SHAFT

Item	Description	Quantity
1	Ring-piston	2
2	Bearing-front 2nd.shaft	1
3	Washer-bearing support	1
4	Bearing clutch gear	1
5	Retaining-ring clutch gear bearing	1
6	Gear-2nd clutch	1
7	Retaining ring - clutch gear bearing	1
8	Bearing - clutch gear	1
9	Snap ring-cluch disc backing plate	1
10	Plate-clutch disc backing	1
11	Modulation spring	1
12	Disc-outer half	1
13	Disc-outer	8
14	Disc-inner	9
15	Disc-outer half	1
16	Ring retaining	1
17	Retainer spring	1
18	Spring clutch-piston return	1
19	Plate spring-clutch piston wear	1
20	Assembly-clutch piston & seals	1
21	Seal-clutch piston-outer	1
22	Seal-clutch piston-inner	1
23	Assembly-2nd shaft,drum & plug	1
24	Snap ring-gear retainer	1
25	Gear-lower output drive	1
26	Gear-upper output	1
27	Bearing rear-2nd shaft	1
28	Flange yoke 1410-upper output	1
29	“O”ring-flange	1
30	Washer-flange nut	1
31	Nut-flange	1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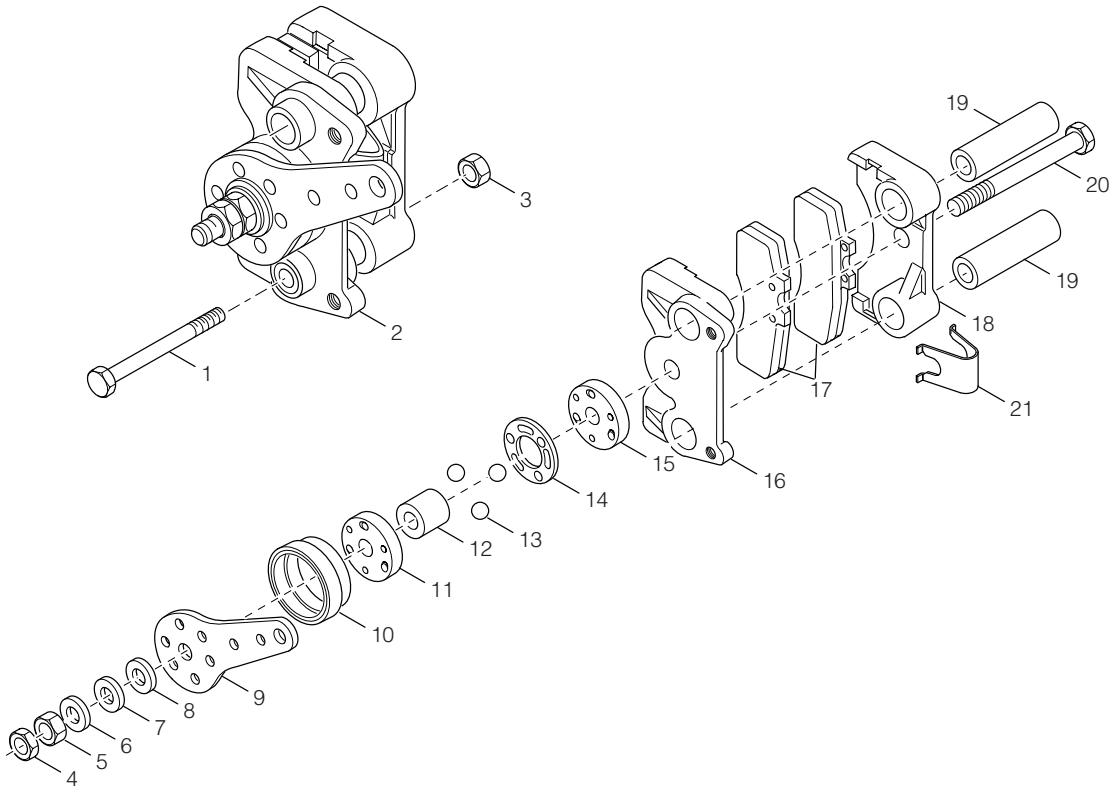
GROUP - OUTPUT SHAFT WITH INTERNAL DISCONNECT

Item	Description	Quantity
1	Nut-flange	1
2	Washer-flange nut	1
3	“O”ring-flange	1
4	Output flange front yoke 1410 with brake disc	1
5	Bearing-output shaft front	1
6	Ring-retaining	1
7	Disconnect hub	1
8	Snapring-gear retainer	1
9	Assembly-output shaft front	1
10	Bushing	2
11	Snapring-clutch disc backing plate	1
12	Spacer	1
13	Plate clutch disc backing	1
14	Disc-outer half	1
15	Disc-outer	11
16	Disc-inner	12
17	Disc-outer half	1
18	Ring-retaining	1
19	Retainer spring	1
20	Spring-piston return	1
21	Plate spring-clutch piston wear	1
22	Assembly-clutch piston & seals	1
23	Seal-clutch piston-outer	1
24	Seal-clutch piston-inner	1
25	Assembly-output shaft rear, drum & plug	1
26	Snapring-gear retainer	1
27	Gear lower output	1
28	Snapring gear retainer	1
29	Snap ring - rear bearing	1
30	Bearing - output shaft rear	1
31	Snap ring - rear bearing	1
32	Ring-piston	3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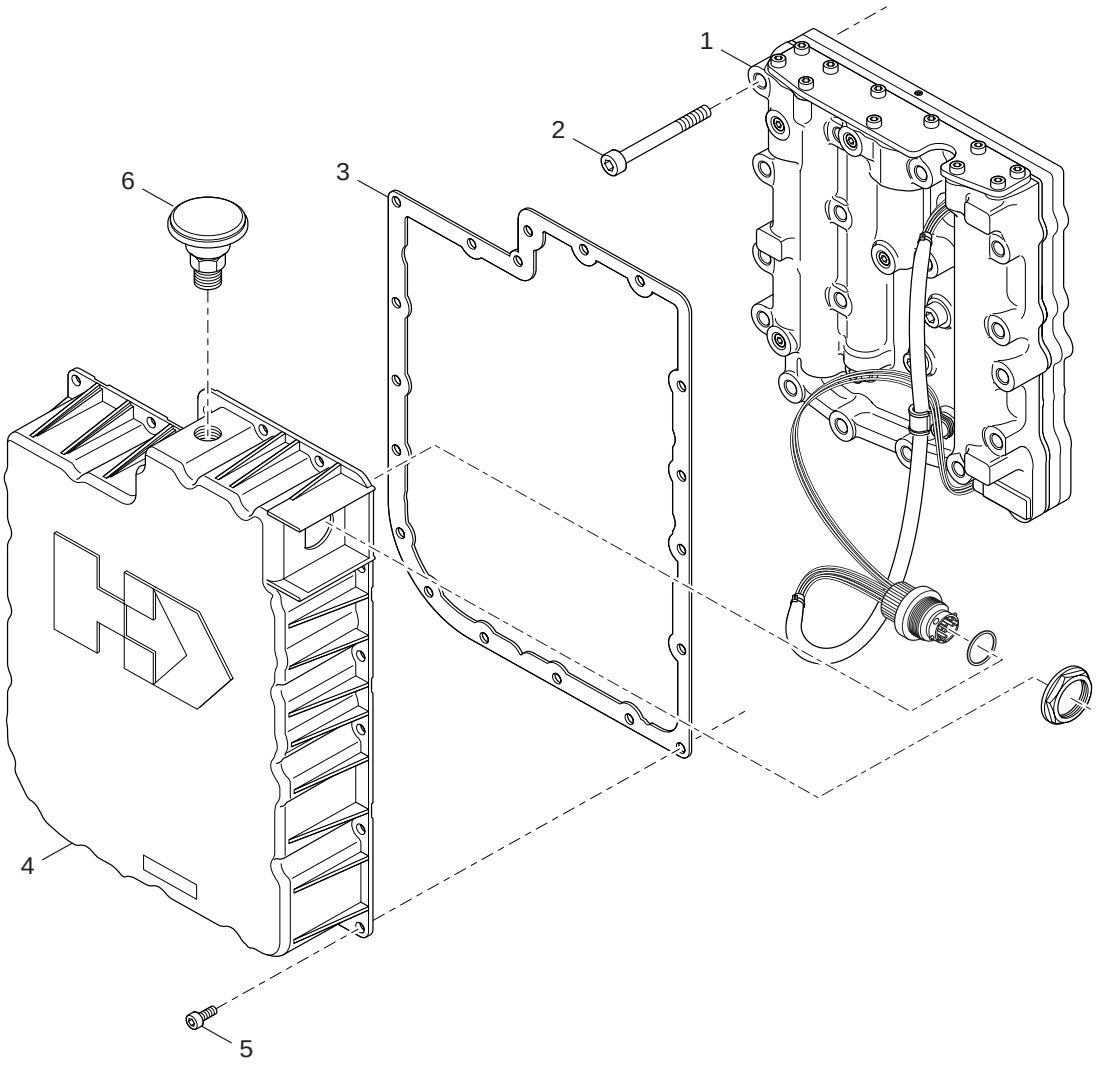
GROUP - PARKING BRAKE

Item	Description	Quantity
1	Screw-brake mounting	2
2	Assembly-caliper	1
3	Nut- brake mounting screw	2
4	Nut-jam adjustment	1
5	Nut-adjustment	1
6	Washer-hardened	1
7	Washer-stainless steel	1
8	Washer-trust	1
9	Lever	1
10	Boot	1
11	Cam	1
12	Id seal	1
13	Ball bearing	3
14	Plastic retainer	1
15	Cam	1
16	Torque plate-front	1
17	Carrier and lining assembly	2
18	Torque plate-rear	1
19	Sleeve mounting	2
20	Bolt-Adjusting	1
21	Spring	1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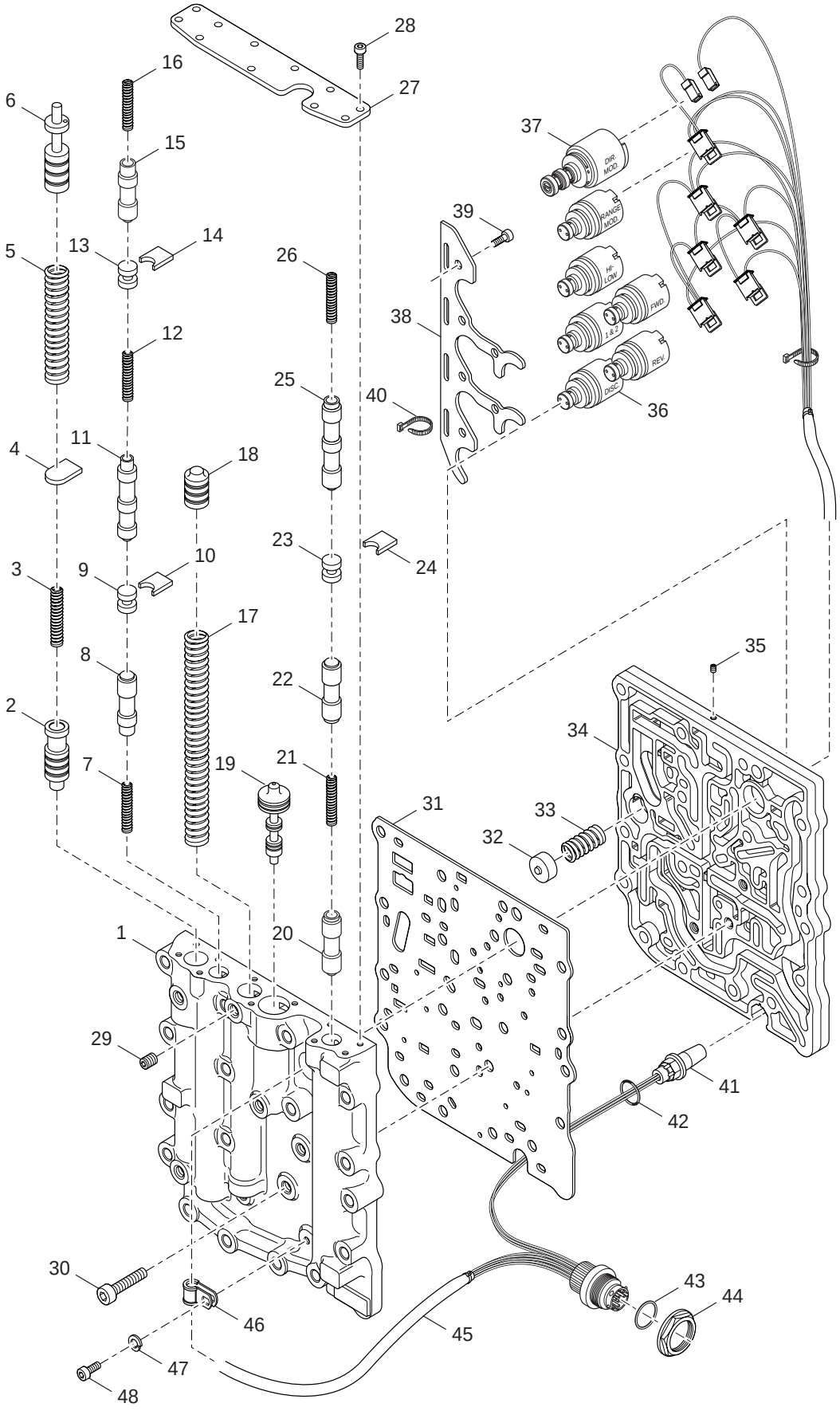
GROUP - MOUNTING ELECTRIC CONTROL VALVE

Item	Description	Quantity
1	Control valve assembly	1
2	Control valve mounting screws	17
3	Control valve protection cover gasket	1
4	Control valve protection cover	1
5	Protection cover screw	20
6	Air breather	1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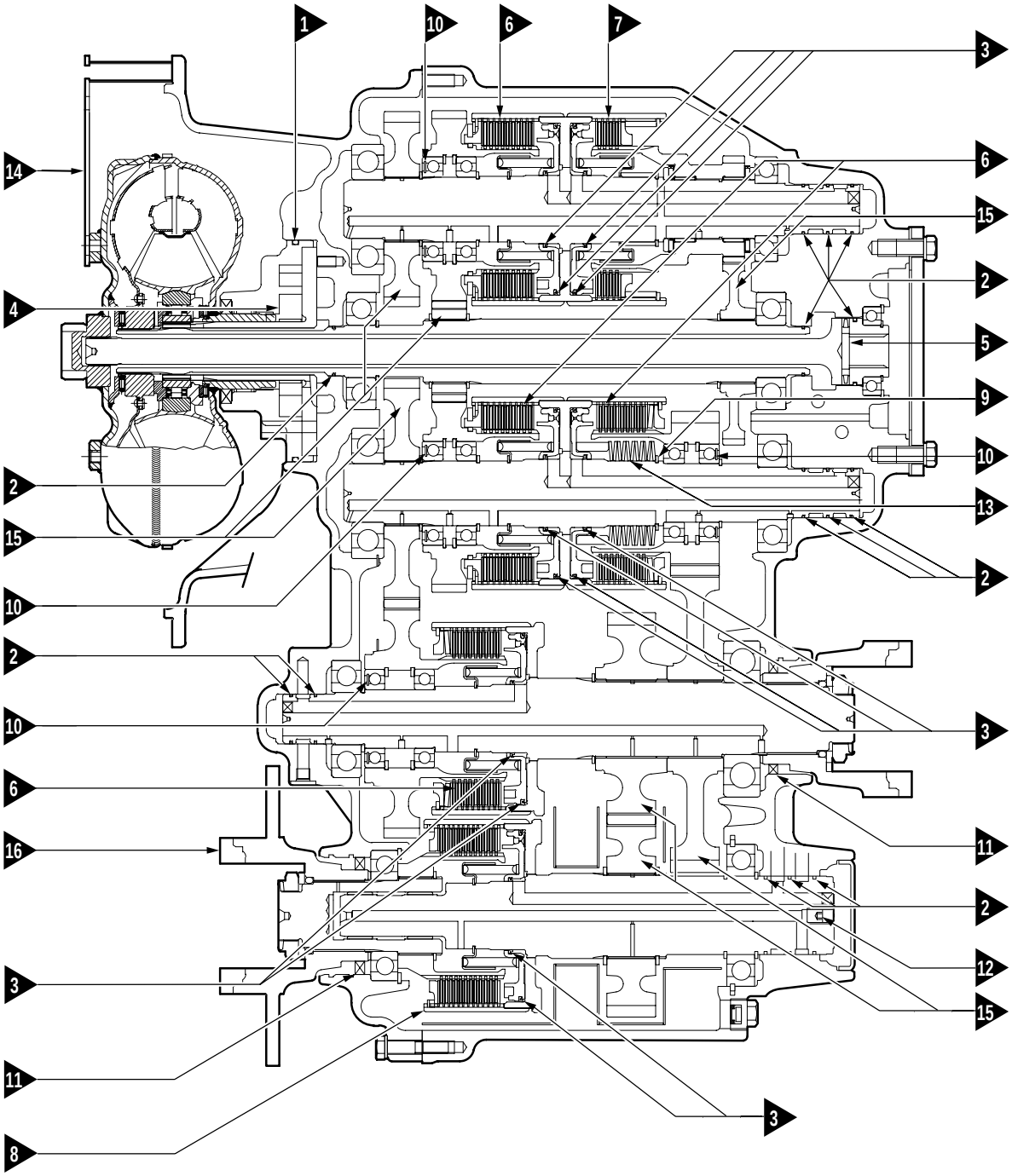
GROUP - ELECTRIC CONTROL VALVE ASSEMBLY

Item	Description	Quantity
1	Spool body	1
2	Pressure reducer spool	1
3	Pressure reducer spring	1
4	Separator plate	1
5	Pressure regulator spring	1
6	Pressure regulator spool	1
7	Pilot spool spring	1
8	Disconnect spool	1
9	Spool stop	1
10	Separator plate	1
11	1st/2nd spool	1
12	Pilot spool spring	1
13	Spool stop	1
14	Separator plate	1
15	Range modulation spool	1
16	Pilot spool spring	1
17	Accumulator spring	1
18	Accumulator spool	1
19	Booster spool	1
20	Reverse spool	1
21	Pilot spool spring	1
22	Forward spool	1
23	Spool stop	1
24	Separator plate	1
25	Fwd. low/Fwd. high spool	1
26	Pilot spool spring	1
27	Spool cover	1
28	Spool cover screw	11
29	Check port plugs	4
30	Spool body to solenoid plate screw	3
31	Spacer plate	1
32	Bypass valve spool	1
33	Bypass valve spring	1
34	Solenoid plate	1
35	Plug	6
36	Solenoid	6
37	Electronic controlled modulation valve	1
38	Solenoid clamp	1
39	Solenoid clamp screw	6
40	Wiring strap	6
41	Speed sensor	1
42	Speed sensor “O” ring	1
43	Jam nut “O” ring	1
44	Jam nut	1
45	Wiring harness, “O” rings and speed sensor assembly	1
46	Wiring clamp	1
47	Clamp screw lockwasher	1
48	Clamp screw	1

ASSEMBLY INSTRUCTIONS



ASSEMBLY INSTRUCTIONS

1. Add some grease to O-ring before assembly.

2. Add some grease to piston rings before assembly slots of piston rings is not allowed to pass bores in housings

3. Teflon seals must be sized prior to assembly, add some grease to inner and outer dia of clutch drum before assembly.

4. Pump must be filled up with test oil prior to assembly.

5. Pump drive shaft must be installed after torque converter

6. Fl, Rev, 1st, and 2nd clutch: 9 separator plates with inner splines. 8 friction plates (friction material both sides) with outer splines, 2 1-side friction plates (friction material 1 side) with outer splines. Start with one 1-side friction plate, metal against piston, then alternately separator and friction plate. End with a 1-side friction plate, metal side against end plate or disc spring. Be sure disc spring is mounted as shown.

   - Clearance: Forward low and Reverse: min. clearance = 2,79 mm, max. clearance = 5,21 mm (for carbon plates)
     If clearance is more than 4,79 mm, add one separator plate upon last separator plate.

   - Clearance: First and second: min. clearance = 2,54 mm, max. clearance = 5,41 mm (for carbon plates)
     If clearance is more than 4,54 mm, add one separator plate upon last separator plate.

7. - Fh clutch: 4 separator plates, 3 friction plates and two 1-side friction plates.

   - Assembly see 6

   - Clearance: min. clearance = 1,24 mm, max. clearance = 2,76 mm (for carbon plates)

8. - Disconnect clutch: 12 separator plates, 11 friction plates and two 1-side friction plates.

   - Assembly see 6

   - Clearance: min. clearance = 3,66 mm, max. clearance = 6,78 mm (for carbon plates)
     If clearance is more than 5,66 mm, add one separator plate upon last separator plate.

9. **CAUTION**: Installation force of disc spring is 3280 N !

10. Be sure that shielded and sealed bearings are mounted as shown.

11. Seals must be pressed in perpendicular upon shaft axis from bearing side. Except lower rear output.

12. Plug to be screwed in and torqued but without Loctite.

13 First clutch springs concave side of first disc spring to be placed against clutch piston wear sleeve. Remaining 10 springs to be stacked alternately reversed as shown.

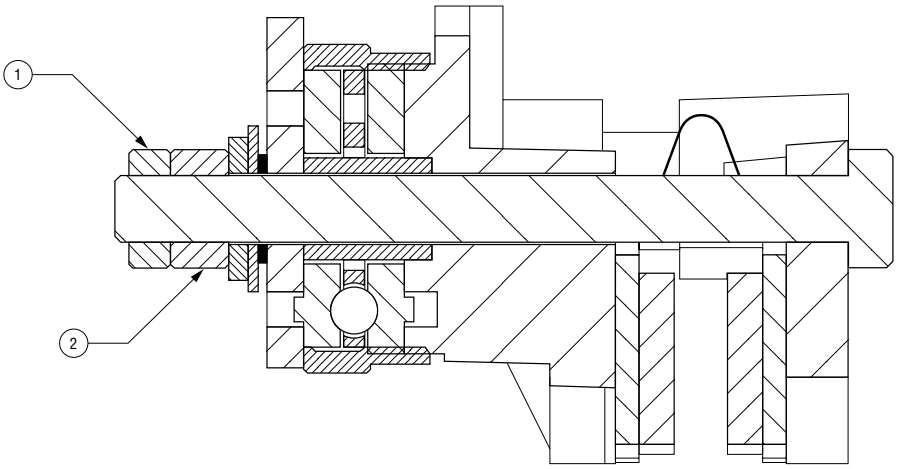
14 Shipping strap: Only used during shipment of the individual transmission.

NOTE: Check if safety valve and valve block are tested before assembly.

15 Heat gears up to 150° C (302 F) before assembling.

16 Parking brake.

17 Mounting: Tighten locking nuts with 0,25 to 1,25 mm clearance between nuts and sleeves. Adjustment: loosen the (2) adjustment locking nuts (1 and 2). Put lever in correct position. Tighten inner adjustment nut (2) with 11 Nm. Back off inner adjustment nut (2) with 4 or 5 flats. Tighten outer locking nut (1) against inner adjustment nut (2).Clearance must be from 0,8 to 1,1 mm.



Warning:

For disassembly and reassembly of this unit you will need, besides normal workshop tools and the special tools mentioned in the last chapter of this manual, a press capable of minimum 20 tons and an induction heater of minimum 3,5 kW to heat gears up to 150° C (302 F).

Figure 1
Remove oil filter.

Figure 4
Remove drive plate screws.

Figure 2
Remove filter adapter screws.

Figure 5
Remove drive plates.

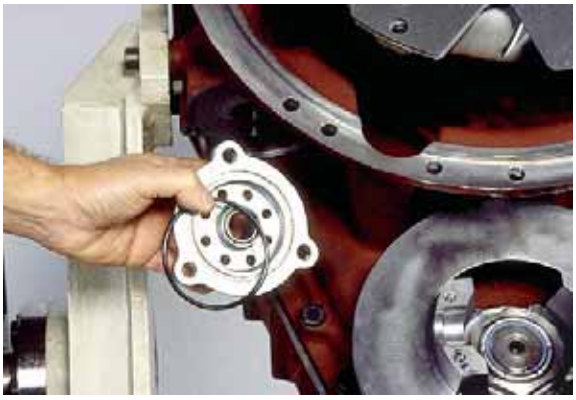


Figure 3
Remove filter adapter with O-ring.

Figure 6
Remove torque converter as an assembly.

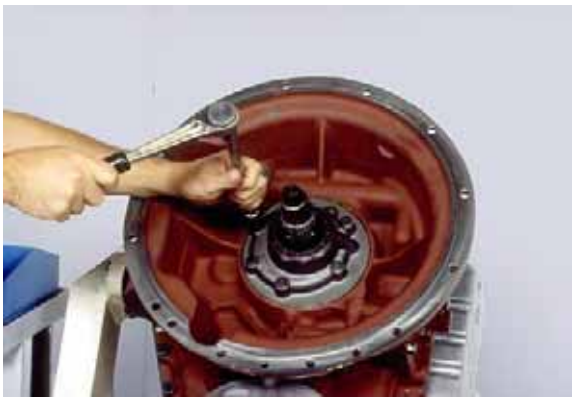


Figure 7
Remove charging pump screws.

Figure 10
Remove parking brake mounting screws.

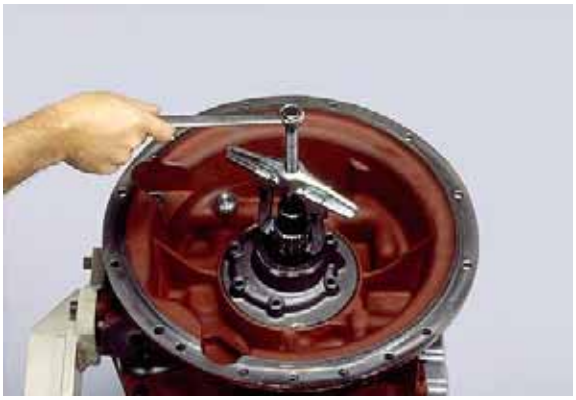


Figure 8
Use a bearing puller to remove charging pump.

Figure 11
Remove parking brake as an assembly.

Figure 9
Remove charging pump as an assembly, remove O-ring.

Figure 12
Remove upper output nut, washer, O-ring and flange.

Figure 13
Remove air breather.

Figure 16
Remove control valve protection cover and gasket.

Figure 14
Remove control valve protection cover mounting screws.

Figure 17
Remove control valve mounting screws.

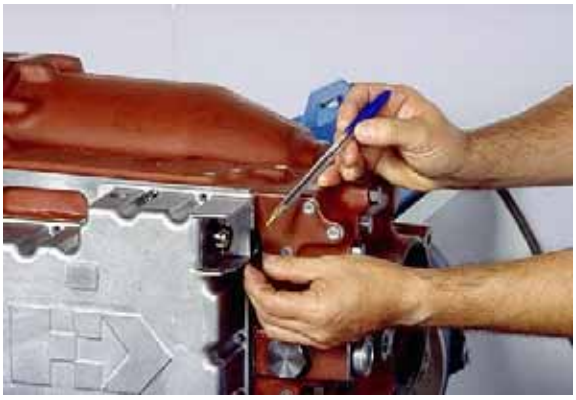


Figure 15
Remove wiring connector mounting nut.

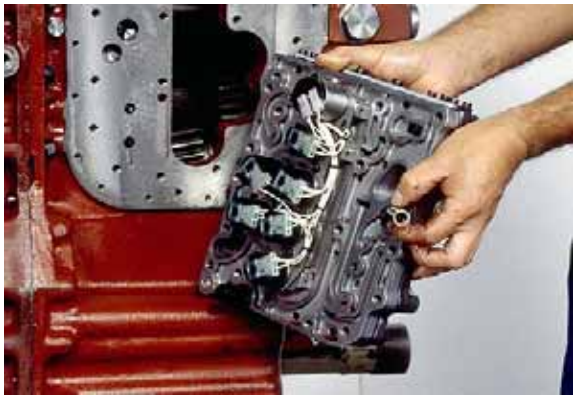


Figure 18
Remove control valve as an assembly: remove bypass valve spool and spring in the meantime.

Figure 19
Remove auxiliary pump hole cover screws.

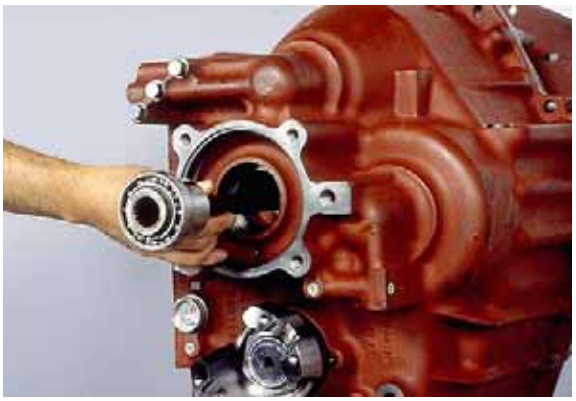


Figure 22
Remove pump drive shaft and bearing as an assembly.

Figure 20
Remove auxiliary pump hole cover and gasket.

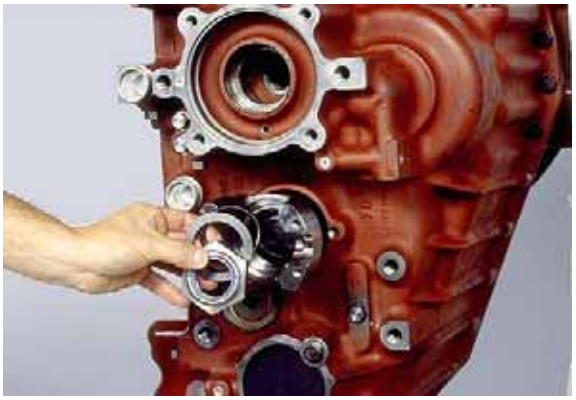


Figure 23
Remove upper output nut, washer, O-ring and flange.

Figure 21
Remove pump drive shaft rear bearing locating ring.

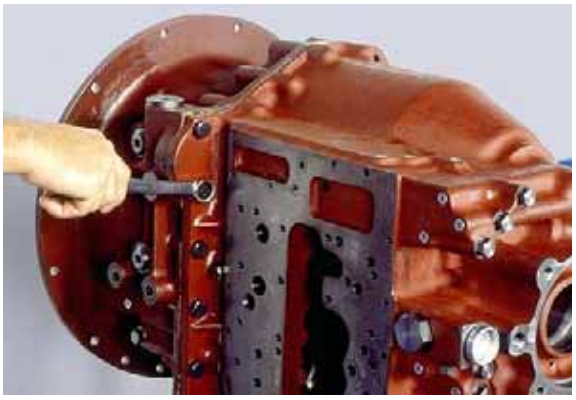


Figure 24
Remove converter housing to transmission case screws and lockwashers.

Figure 25
Remove transmission case plug.

Figure 28
Transmission case removed all drums and shafts remain in converter housing.

Figure 26
Transmission case plug and gasket removed.

Figure 29
Remove transmission case to converter housing gasket.

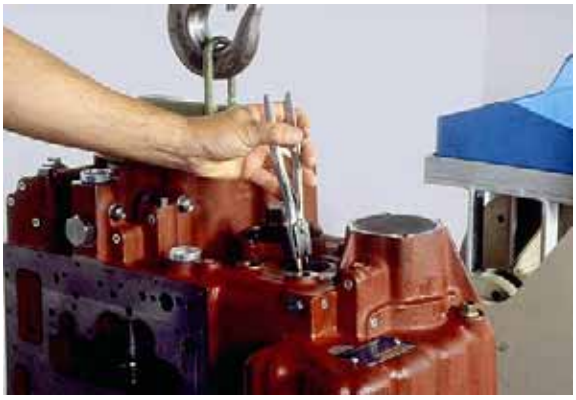


Figure 27
Using spreading type snap ring plier, spread ears on output shaft rear bearing retaining ring. Holding snap ring open, tap on output shaft and transmission case to remove case from converter housing.
Lift transmission case from converter housing (using lifting bracket).

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Figure 30
Remove output shaft sealing rings.

Figure 31
Remove output shaft rear bearing retaining ring.

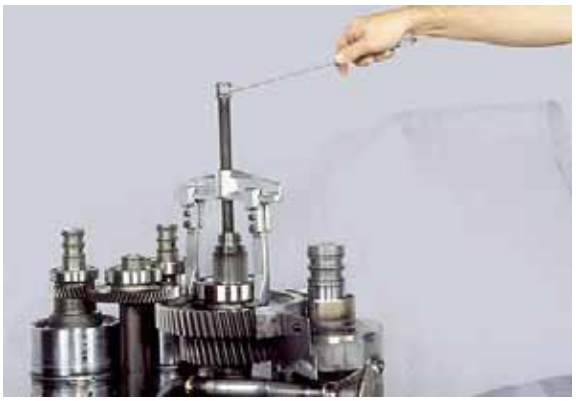

Figure 34
Using bearing puller to remove 2nd shaft rear bearing.

Figure 32
Use bearing puller to remove output shaft rear bearing.

Figure 35
2nd shaft rear bearing removed.

Figure 33
Output shaft rear bearing removed.

Figure 36
Using bearing puller to remove input shaft rear bearing.

Figure 37
Input shaft rear bearing removed.

Figure 40
Reverse and 1st shaft rear bearing removed.

Figure 38
Remove reverse and 1st shaft sealing rings.

Figure 41
Remove forward low and forward high shaft sealing rings.

Figure 39
Using bearing puller to remove reverse and 1st shaft rear bearing.

Figure 42
Using bearing puller to remove forward low and forward high shaft rear bearing.

Figure 43

Forward low and forward high shaft rear bearing removed.

Figure 46

Remove baffle plates screws, remove baffle plates.

Figure 44

Use bearing puller to remove forward high gear from the input shaft.

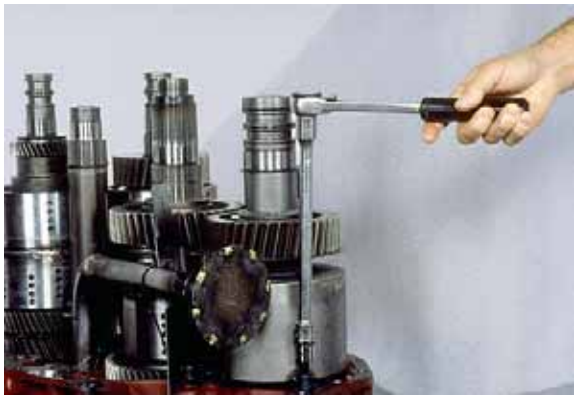

Figure 47

Remove oil baffle to converter housing screws, do not remove oil baffle from output shaft.

Figure 45

Forward high gear removed.

Figure 48

Remove output shaft, 2nd shaft and oil baffle at the same time.

Figure 49
Loosen suction tube retainer screw.

Figure 52
Remove suction tube O-ring and washer.

Figure 50
Remove suction tube retainer screw and lockwasher.

Figure 53
Remove output shaft front bearing retainer ring.

Figure 51
Remove suction tube retainer ring.

Figure 54
Remove output shaft front assembly.

Figure 55

Remove input shaft, reverse and forward shaft at the same time.

Figure 56

Remove safety valve plug, spring and ball.

Figure 57

Remove by-pass plug, spring and ball.

Figure 58
Remove clutch shaft sealing rings.

Figure 61
Remove clutch gear.

Figure 59
Remove thrust washer and thrust bearing.

Figure 62
Remove clutch gear inner needle bearing.

Figure 60
Remove clutch gear outer needle bearing.

Figure 63
Remove thrust washer and thrust bearing.

Figure 64
Remove backing plate retaining ring.

Figure 67
Remove one outer half disc.

Figure 65
Remove clutch plate spacer.

Figure 68
Remove inner and outer discs.

Figure 66
Remove clutch disc backing plate.

Figure 69
Remove one outer half disc.

Figure 70
Compress spring to remove spring retainer snap ring.

Figure 73
Remove clutch piston spring retainer.

Figure 71
Remove spring retainer snap ring.

Figure 74
Remove clutch piston spring.

Figure 72
Remove clutch spring spacer.

Figure 75
Remove clutch piston wear plate.

Figure 76
Remove clutch piston assembly.

Figure 77
Use bearing puller to remove front bearing and gear.

Figure 80
Use a bearing puller to remove clutch gear and outer bearing.

Figure 78
Front bearing and gear removed.

Figure 81
Clutch gear and outer bearing removed.

Figure 79
Remove gear retainer ring.

Figure 82
Remove spacer snap ring.

Figure 83
Remove spacer.

Figure 84
Remove backing plate retaining ring.

Figure 85
Remove clutch disc backing plate.

Figure 86
Use a bearing puller to remove clutch gear inner bearing

Figure 87
Clutch gear inner bearing removed.

Figure 88
Remove one outer half disc.

Figure 89
Remove inner and outer discs.

Figure 92
Compress spring to remove spring retainer snap ring.

Figure 90
Remove one outer half disc.

Figure 93
Remove spring retainer snap ring.

Figure 91
Remove clutch gear inner bearing locating ring.

Figure 94
Remove clutch piston spring retainer.

Figure 95
Remove clutch piston spring.

Figure 96
Remove clutch piston wear plate.

Figure 97
Remove clutch piston assembly.

Figure 98

Install clutch piston outer seal. **Note:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until sealing ring is flush with outer diameter of piston.

Figure 101

Install clutch piston spring.

Figure 99

Install clutch piston inner seal.
Install clutch piston in clutch drum,
use caution as not to damage sealing rings.

Figure 102

Install clutch piston spring retainer.

Figure 100

Install clutch piston wear plate on piston.

Figure 103

Install clutch spring retainer snap ring.

Figure 104

Use a sleeve with the proper diameter to fit over shaft and against retainer ring. A sharp blow with a shoft hammer will compress spring and seat retainer ring. Be sure ring is in full position in groove.

Figure 107

Install one outer half disc with friction material down.

Figure 105

Install one outer half disc, with friction material away from the piston.

Figure 108

Install backing plate.

Figure 106

Install one steel disc. Alternate friction and steel discs until the proper amount of discs are installed. First and last discs are steel.

Figure 109

Install backing plate snap ring.

Figure 110
Install spacer.

Figure 113
Install clutch gear inner bearing.

Figure 111
Install spacer snap ring.

Figure 114
Tap inner bearing into place.

Figure 112
Install inner bearing snap ring.

Figure 115
Install clutch gear bearing locating rings.

Figure 116

Install clutch gear sealing ring. Install clutch gear in clutch drum. Align splines on clutch gear with internal teeth of steel discs. Do not force this operation. Gear splines must be in full position with internal teeth of all inner discs.

Figure 119

Install outer bearing snap ring.

Figure 117

Install clutch gear outer bearing.
Be sure that bearing shield is on the outside.

Figure 120

Warm gear to 150° C (302 F), install gear.

Figure 118

Tap outer bearing into place.

Figure 121

Warm front bearing to 120° C (248 F), install bearing.

Figure 122

Install clutch outer seal. **Note:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until sealing ring is flush with outer diameter of piston.

Figure 125

Install clutch piston return spring.

Figure 123

Install piston inner seal and install clutch piston in clutch drum; use caution as not to damage sealing rings.

Figure 126

Install piston return spring retainer.

Figure 124

Install clutch piston wear plate on piston.

Figure 127

Install spring retainer spacer.

Figure 128

Install clutch spring retainer snap ring.

Figure 131

Install one steel disc. Alternate friction and steel discs until the proper amount of discs are installed, first and last discs are steel.

Figure 129

Use a sleeve with the proper diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress spring and seat retainer ring. Be sure ring is in full position in groove.

Figure 132

Install one outer half disc with friction material down.

Figure 130

Install one outer half disc with friction material away from the piston.

Figure 133

Install backing plate.

Figure 134
Install backing plate spacer.

Figure 137
Install clutch gear inner needle bearing.

Figure 135
Install backing plate spacer retainer ring.

Figure 138
Install clutch gear in clutch drum. Align splines on clutch gear with internal teeth of steel discs.
Do not force this operation. Gear splines must be in full position with internal teeth of all inner discs.

Figure 136
Install thrust washer and thrust bearing.

Figure 139
Install clutch gear outer needle bearing.

Figure 140
Install thrust washer and thrust bearing.

Figure 141
Install clutch shaft sealing rings.

Figure 142
Remove clutch shaft sealing rings.

Figure 145
Clutch gear and outer bearing removed.

Figure 143
Remove clutch gear bearing retainer ring.

Figure 146
Remove backing plate retainer ring.

Figure 144
Use a bearing puller to remove clutch gear and outer bearing.

Figure 147
Remove backing plate.

Figure 148
Remove modulation spring.

Figure 151
Remove one outer half disc.

Figure 149
Use bearing puller to remove clutch gear inner bearing.

Figure 152
Remove inner and outer discs.

Figure 150
Clutch gear inner bearing removed.

Figure 153
Remove one outer half disc.

Figure 154
Compress clutch piston belleville washer spring. Remove spring snap ring.

⚠ **Note:** Force of disc spring is 3.280N !

Figure 155
Spring retainer ring removed.

Figure 156
Remove disc belleville washer spring.

Figure 157
Remove clutch piston wear sleeve.

Figure 158
Remove clutch piston assembly.

Figure 159
Use a bearing puller to remove gear and front bearing.

Figure 162
Use a bearing puller to remove clutch gear and clutch gear outer bearing.

Figure 160
Gear and front bearing removed.

Figure 163
Clutch gear and outer bearing removed.

Figure 161
Remove clutch gear bearing retaining ring.

Figure 164
Remove spacer snap ring.

Figure 165
Remove spacer.

Figure 166
Remove backing plate retaining ring.

Figure 167
Remove clutch disc backing plate.

Figure 168
Use a bearing puller to remove clutch gear inner bearing.

Figure 169
Clutch gear inner bearing removed.

Figure 170
Remove one outer half disc.

Figure 171
Remove inner and outer discs.

Figure 174
Compress spring to remove spring retainer snap ring.

Figure 172
Remove one outer half disc.

Figure 175
Remove spring retainer snap ring.

Figure 173
Remove inner bearing locating ring.

Figure 176
Remove clutch piston spring retainer.

Figure 177
Remove clutch piston spring.

Figure 178
Remove clutch piston wear plate.

Figure 179
Remove clutch piston assembly.

Figure 180

Install clutch piston outer seal. **Note:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until sealing ring is flush with outer diameter of piston.

Figure 183

Install clutch piston spring.

Figure 181

Install clutch piston inner seal. Install clutch piston in clutch drum, use caution as not to damage sealing rings.

Figure 184

Install clutch piston spring retainer.

Figure 182

Install piston wear plate on piston.

Figure 185

Install clutch spring retainer snap ring.

Figure 186

Use a sleeve with the proper diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress spring and seat retainer ring. Be sure ring is in full position in groove.

Figure 189

Install one outer half disc with friction material down.

Figure 187

Install one outer half disc, with friction material away from the piston.

Figure 190

Install backing plate.

Figure 188

Install one steel disc. Alternate friction and steel discs until the proper amount of discs are installed. First and last discs are steel.

Figure 191

Install backing plate snap ring.

Figure 192
Install spacer.

Figure 195
Install clutch gear inner bearing.

Figure 193
Install spacer snap ring.

Figure 196
Tap inner bearing into place.

Figure 194
Install inner bearing snap ring.

Figure 197
Install clutch gear bearing locating rings.

Figure 198

Install clutch gear sealing ring. Install clutch gear in clutch drum. Align splines on clutch gear with internal teeth of steel discs. Do not force this operation. Gear splines must be in full position with internal teeth of all inner discs.

Figure 201

Install outer bearing snap ring.

Figure 199

Install clutch gear outer bearing.

⚠ Be sure that bearing shield is on the outside.

Figure 202

Warm gear to 150° C (302 F), install gear.

Figure 200

Tap outer bearing into place.

Figure 203

Warm front bearing to 120° C (248 F), install bearing.

Figure 204

Install clutch piston outer seal. **Note:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until sealing ring is flush with outer diameter of piston.

Figure 205

Install piston inner seal. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

Figure 206

Install clutch piston wear sleeve.

Figure 207

Install piston return disc springs. First spring with large diameter of bevel toward wear sleeve. Alternate eleven (11) springs.

Figure 208

Install disc belleville washer spring retainer ring.

Figure 209

Compress spring to install spring retainer ring. Be sure ring is in full position in groove.

Figure 210

Install one outer half disc with friction material away from the piston.

Figure 213

Install modulation spring with large diameter up to the backing plate.

Figure 211

Install one steel disc. Alternate friction and steel discs until the proper amount of discs are installed. First and last discs are steel.

Figure 214

Install backing plate.

Figure 212

Install one outer half disc with friction material down.

Figure 215

Install backing plate snap ring.

Figure 216
Install clutch disc hub inner bearing.

Figure 219
Install clutch hub outer bearing.
Be sure that bearing shield is on the outside.

Figure 217
Tap inner bearing into place.

Figure 220
Tap outer bearing into clutch hub.

Figure 218
Install clutch hub bearing locating rings. Install clutch gear in clutch drum. Align splines on clutch gear witch internal teeth of steel discs. Do not force this operation. Gear splines must be in full position with internal teeth of all steel discs.

Figure 221
Install outer bearing retaining ring.

Figure 222
Install clutch shaft sealing rings.

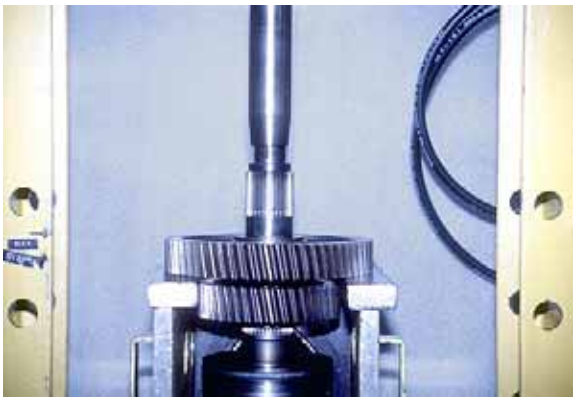

Figure 223
Press upper output gear from 2nd shaft.

Figure 226
Remove clutch shaft sealing rings.

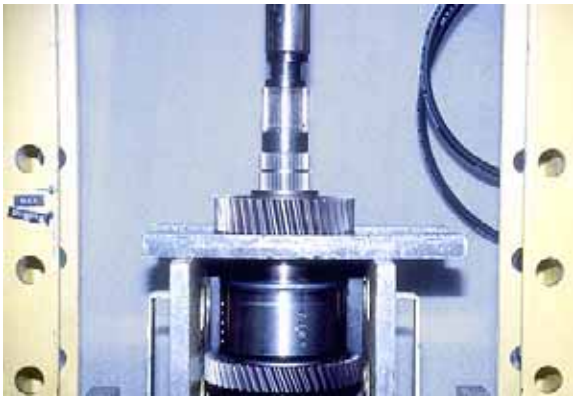

Figure 224
Press gear from 2nd shaft.

Figure 227
Use bearing puller to remove clutch hub and front bearing.

Figure 225
Remove gear retaining ring.

Figure 228
Remove clutch shaft front bearing.

Figure 229
Remove bearing washer.

Figure 232
Remove clutch hub inner bearing.

Figure 230
Remove clutch hub and outer bearing.

Figure 233
Remove backing plate snap ring.

Figure 231
Use a bearing puller to remove clutch hub inner bearing.

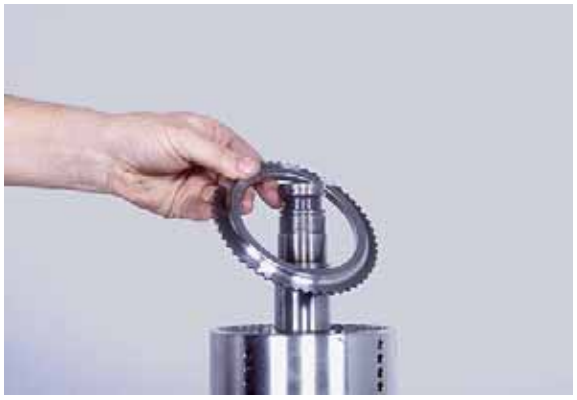

Figure 234
Remove backing plate.

Figure 235
Remove modulation spring.

Figure 236
Remove one outer half disc.

Figure 237
Remove inner and outer discs.

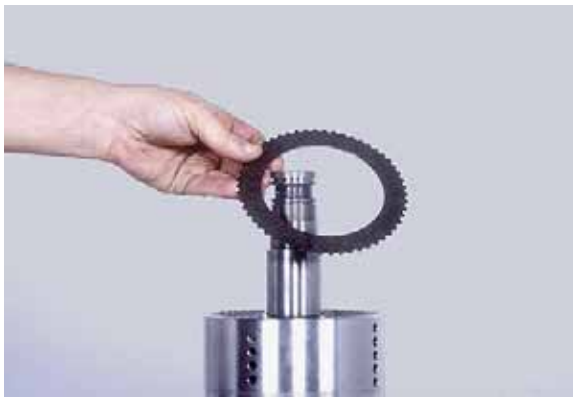

Figure 238
Remove one outer half disc.

Figure 239
Compress spring to remove spring retaining ring.

Figure 240
Remove spring retaining ring.

Figure 241
Remove spring retainer.

Figure 242
Remove clutch piston return spring.

Figure 243
Remove piston wear plate.

Figure 244
Remove clutch piston assembly.

Figure 245

Install piston outer seal. **Note:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until sealing ring is flush with outer diameter of piston.

Figure 248

Install piston return spring.

Figure 246

Install clutch piston inner seal.
Install clutch piston in clutch drum.
Use caution as not to damage sealing rings.

Figure 249

Install spring retainer.

Figure 247

Install piston wear plate.

Figure 250

Install spring retainer snap ring.

Figure 251

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress spring and seat retainer ring. Be sure ring is in full position in groove.

Figure 252

Install one outer half disc with friction material away from the piston.

Figure 253

Install one steel disc. Alternate friction and steel discs until the proper amount of discs are installed. First and last discs are steel.

Figure 254

Install one outer half disc with friction material down.

Figure 255

Install modulator spring with large diameter up to the backing plate.

Figure 256

Install backing plate.

Figure 257
Install backing plate retainer ring.

Figure 260
Install clutch hub bearing locating rings. Install clutch gear in clutch drum. Align splines on clutch gear with internal teeth of steel discs. Do not force this operation. Gear splines must be in full position with internal teeth of all steel discs.

Figure 258
Install clutch hub inner bearing.

Figure 261
Install clutch hub outer bearing.

⚠ Be sure that bearing shield is on the outside.

Figure 259
Tap clutch gear inner bearing into place.

Figure 262
Tap outer bearing into place.

Figure 263
Install bearing washer.

Figure 266
Install gear retaining ring.

Figure 264
Warm front bearing to 120° C (248 F), install bearing.

Figure 267
Warm gear to 150° C (302 F), install gear.

Figure 265
Install clutch shaft sealing rings.

Figure 268
Warm upper output gear to 150° C (302 F) install gear.

Figure 269
Remove oil baffle screws and nuts.

Figure 272
Remove output shaft gear retaining ring.

Figure 270
Remove oil baffle.

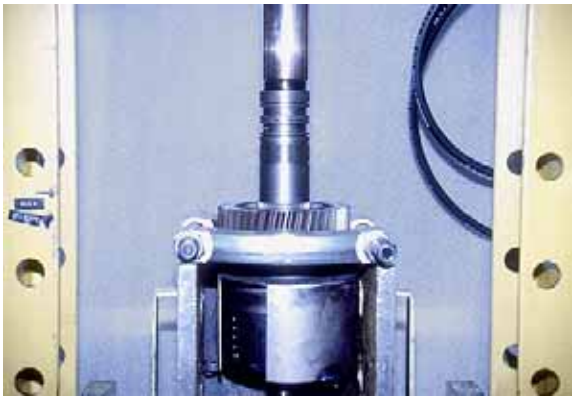

Figure 273
Press output gear from shaft.

Figure 271
Remove output shaft sealing rings.

Figure 274
Remove output gear.

Figure 275
Remove oil baffle from output shaft.

Figure 278
Remove backing plate spacer.

Figure 276
Remove gear retaining ring.

Figure 279
Remove backing plate.

Figure 277
Remove backing plate snap ring.

Figure 280
Remove one outer half disc.

Figure 281
Remove inner and outer discs.

Figure 284
Remove spring retaining ring.

Figure 282
Remove one outer half disc.

Figure 285
Remove spring retainer.

Figure 283
Compress spring to remove spring retaining ring.

Figure 286
Remove clutch piston spring.

Figure 287
Remove piston wear plate.

Figure 288
Remove piston assembly.

Figure 289

Install piston outer seal. **Note:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until sealing ring is flush with outer diameter of piston.

Figure 292

Install clutch piston spring.

Figure 290

Install clutch piston inner seal.
Install clutch piston in clutch drum.
Use caution as not to damage sealing rings.

Figure 293

Install spring retainer.

Figure 291

Install piston wear plate on piston.

Figure 294

Install spring retainer snap ring. Use a sleeve with the proper inner diameter to fit over shaft and against snap ring. A sharp blow of a soft hammer will compress spring and seat retainer ring. Be sure ring is in full position in groove.

Figure 295

Install one outer half disc with friction material away from the piston.

Figure 298

Install backing plate.

Figure 296

Install one steel disc. Alternate friction and steel discs until the proper amount of discs are installed. First and last discs are steel.

Figure 299

Install backing plate spacer.

Figure 297

Install one half disc with friction material down

Figure 300

Install backing plate snap ring.

Figure 301
Install oil baffle on output shaft.

Figure 304
Install output gear retaining ring.

Figure 302
Install output gear retaining ring.

Figure 305
Install output shaft sealing rings.

Figure 303
Warm gear to 150° C (302 F), install gear.

Figure 306
Install rear oil baffle on output shaft.

Figure 307

Install oil baffle mountng screws, washer and nuts and tighten nuts to specified torque (Use Loctite 243).

Figure 308
Use bearing puller to remove disconnect shaft front bearing.

Figure 311
Remove clutch hub from shaft.

Figure 309
Remove front bearing.

Figure 312
Remove clutch hub locating ring from shaft.

Figure 310
Remove front bearing retaining ring.

Figure 313
Install bushing if necessary.

Figure 316
Install front bearing retaining ring.

Figure 314
Install clutch hub locating ring.

Figure 317
Install front bearing on shaft.

Figure 315
Install clutch hub on shaft.

Figure 318
Tap bearing on shaft.

Figure 319
Remove rear bearing snap ring.

Figure 322
Remove sealing ring from shaft.

Figure 320
Use bearing puller to remove rear bearing.

Figure 321
Remove rear bearing from shaft.

Figure 323
Install sealing ring on shaft.

Figure 326
Install rear bearing retainer ring.

Figure 324
Install rear bearing on shaft.

Figure 325
Tap bearing into place.

Figure 327
Remove input shaft rear sealing ring.

Figure 330
Remove input shaft front sealing ring.

Figure 328
Remove forward high gear retaining ring.

Figure 331
Use bearing puller to remove input shaft front bearing.

Figure 329
Remove forward low gear retaining ring.

Figure 332
Remove input shaft front bearing.

Figure 333
Remove input shaft front bearing retaining ring.

Figure 334
Remove forward low gear retaining ring.

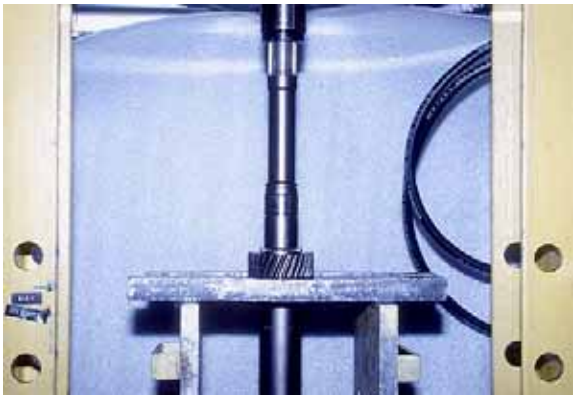

Figure 335
Press forward low gear from shaft.

Figure 336
Install forward low gear retaining ring.

Figure 339
Install input shaft front bearing retaining ring.

Figure 337
Warm gear to 150° C (302 F), install gear.

Figure 340
Install input shaft front sealing ring.

Figure 338
Install forward low gear retaining ring.

Figure 341
Warm input shaft front bearing to 120° C (248 F), install bearing.

Figure 342
Turn shaft and install input shaft forward high gear retaining ring.

Figure 343
Install input shaft rear sealing ring.

Figure 344
Install safety valve ball spring and plug.

Figure 347
Tap seal into place.

Figure 345
Install by-pass valve ball spring and plug.

Figure 348
Install input shaft into housing and in the meantime install reverse and first shaft (they have to be installed together). Using caution as not to damage any of the first shaft sealing rings.

Figure 346
Install output shaft front oil seal.

Figure 349
Install forward low shaft and high shaft into housing. Using caution as not to damage any sealing rings.

Figure 350
Install disconnect shaft assembly into housing.

Figure 353
Install baffle plate, mounting screws, washers and nuts. Tighten nuts to specified torque. (Use Loctite 243).

Figure 351
Open bearing retaining ring. Tap shaft into place. Be sure ring is in groove.

Figure 354
Install baffle plate, mounting screws, washers and nuts. Tighten nuts to specified torque. (Use Loctite 243).

Figure 352
Install upper and lower output at the same time. Do not force this operation, be sure discs of disconnect are in full position. Using caution as not to damage any of the lower shaft sealing rings.

Figure 355
Install oil baffle, mounting screws and washers. Tighten screws to specified torque. (Use Loctite 243).

Figure 356

Install O-ring, spacer and snap ring on suction tube. Install suction tube into housing. Be sure ring is in groove.

Figure 357

Install suction tube retainer, mounting screw and lockwasher (Use Loctite 243).

Figure 358

Tighten mounting screw to specified torque.

Figure 359

Install output shaft rear bearing retaining ring.

Figure 360

Warm forward high gear to 150° C (302 F), install gear.

Figure 361

Warm upper output rear bearing to 120° C (248 F), install bearing.

Figure 362

Warm reverse and 1st shaft rear bearing to 120° C (248 F), install bearing.

Figure 365

Warm lower output shaft rear bearing to 120° C (248 F), install bearing.

Figure 363

Warm input shaft rear bearing to 120° C (248 F), install bearing.

Figure 366

Install output shaft rear bearing retaining ring.

Figure 364

Warm forward low and high shaft rear bearing to 120° C (248 F), install bearing.

Figure 367

Install gasket and clutch pressure O-rings (4) into O-ring grooves.

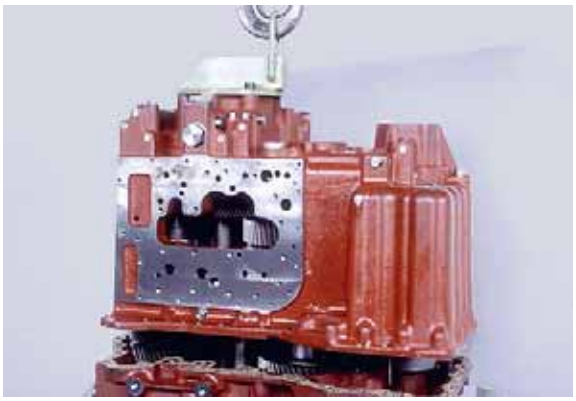

Figure 368

Remove lower output bore plug. Position transmission case on converter housing (using lifting bracket).

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P10-1

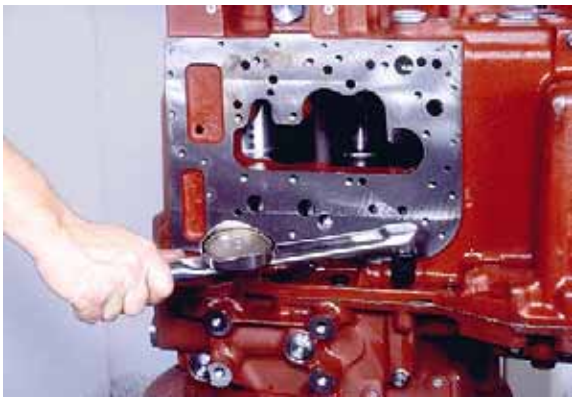


Figure 371

Install transmission case to converter housing mounting screws and lockwashers. Tighten mounting screws to specified torque.

Figure 369

Using spreading type snap ring pliers, spread ears on output shaft rear bearing retaining ring. Holding snap ring open. Tap transmission case into place.

Figure 372

Using spreading type snap ring plier, spread ears on output shaft rear bearing retaining ring. Hold snap ring open, pry or lift output shaft. Be sure retaining ring is complete in bearing groove. (Using a lifting eye or screw M12).

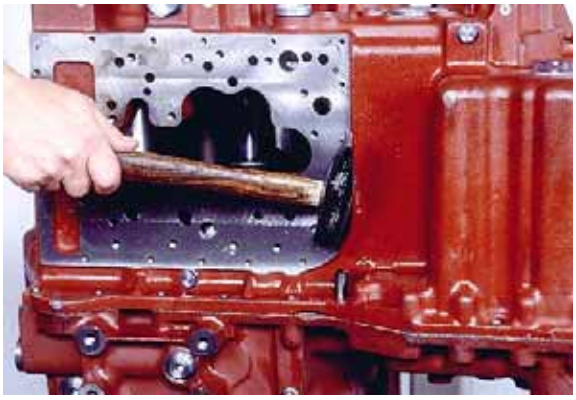


Figure 370

Tap dowel pin in transmission case and converter housing.

Figure 373

Install hole plug and gasket.

Figure 374
Tighten plug to 13,6 - 20,3 Nm (10 -15 lbft).

Figure 377
Tap seal into place.

Figure 375
Position lower output bore plug and tap bore plug into place.

Figure 378
Install upper output flange, O-ring, washer and nut and tighten nut to 339-407 Nm. (205-300 lbft).

Figure 376
Position upper output seal.

Figure 379
Install pump drive shaft assembly into housing.

Figure 380
Install pump drive shaft rear bearing retaining ring.

Figure 383
Install pump and O-ring into converter housing.

Figure 381
Install pump hole cover , gasket, screws and lockwashers.

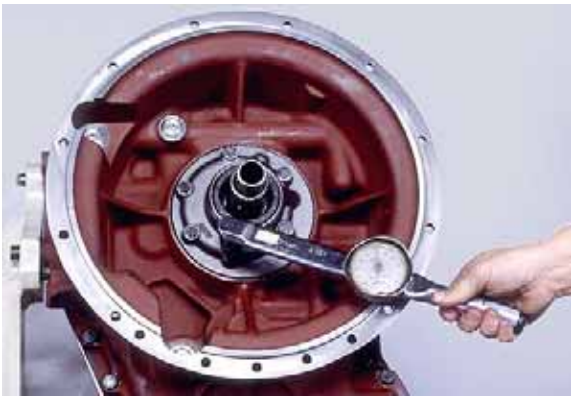


Figure 384
Install pump mounting screws and lockwashers and tighten screws to specified torque.

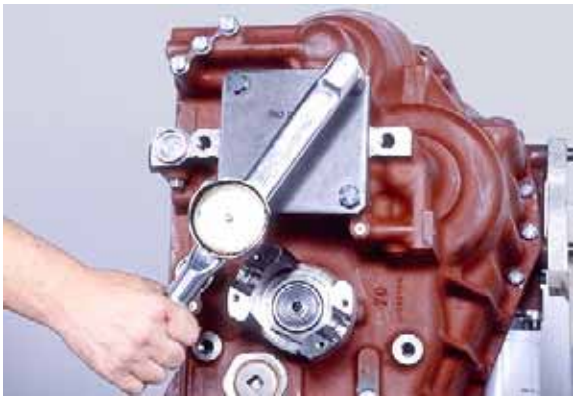


Figure 382
Tighten pump hole cover screws to specified torque.

Figure 385
Install convertor assembly on input shaft.

Figure 386
Install drive plates on converter.

Figure 389
Tighten screws to specified torque.

Figure 387
Install drive plates screws and lockwashers and tighten screws to specified torque.

Figure 390
Install oil filter and tighten to 30 - 38 Nm (22,1 - 28 lbft).

Figure 388
Install filter adapter, O-ring, lockwashers and mounting screws.

Figure 391
Instal output shaft front flange, O-ring, washer and nut. Tighten nut to 339 - 407 Nm (250 - 300 lbft).

Figure 392

Position parking brake , install mounting screws (See packing brake adjustment).

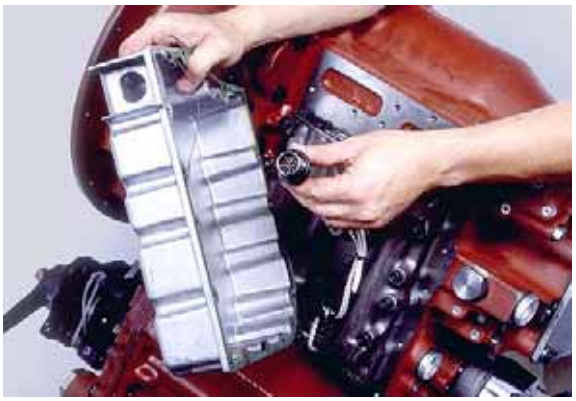


Figure 395

Position wiring connector in valve protection cover.

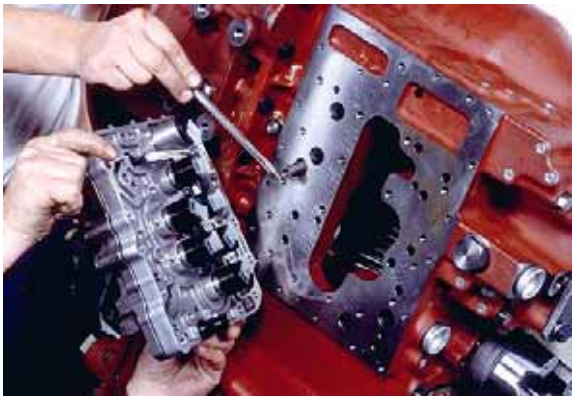


Figure 393

Install by-pass valve spool into solenoid housing and spring into transmission case, position control valve on transmission case.

Figure 396

Install gasket and valve protection cover mounting screws and tighten screws to specified torque.

Figure 394

Install control valve mounting screws and lockwashers, tighten screws to specified torque.

Figure 397

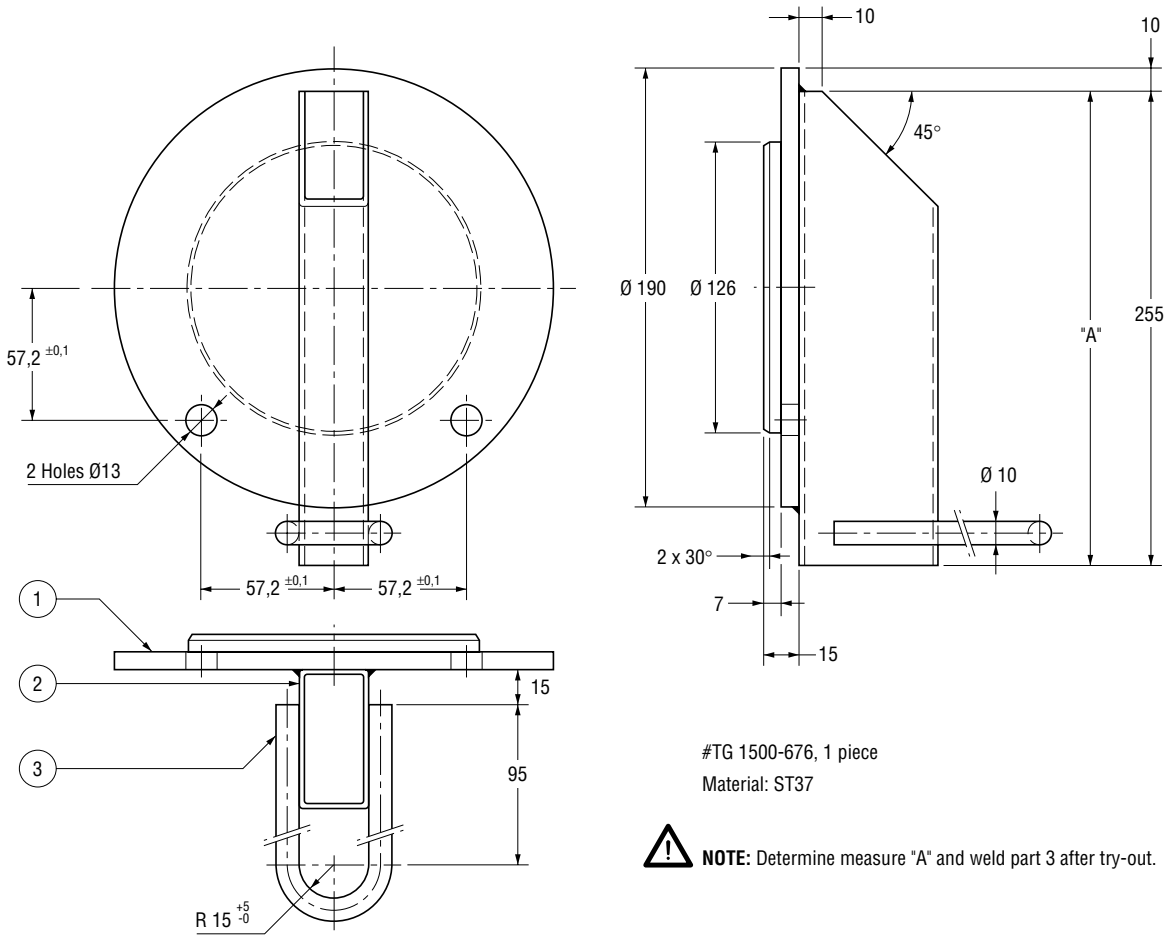
Install air breather and tighten to 34 - 41 Nm (25 - 30 lbft).

Figure 398

Install wiring connector nut and tighten to 6 - 8 Nm (4,4 - 5,9 lbft).

SERVICE TOOLS

1. LIFTING BRACKET



#TG 1500-676, 1 piece
Material: ST37

NOTE: Determine measure "A" and weld part 3 after try-out.

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